

Savitribai Phule Pune University

Board of Studies in Civil Engineering

Structure for B.E. Civil 2012 Course (w.e.f. June 2015)

Subject code	Subject	Semester – I							
		Teaching Scheme Hrs/Week			Examination Scheme				
		Lect	Tu	Pr	In-Semester Assessment	TW	Or	End - Semester Exam	Total
401 001	Environmental Engineering II	3		2	30	--	50	70	150
401 002	Transportation Engineering	3		2	30	50	--	70	150
401 003	Structural Design and Drawing III	4		2	30	--	50	70	150
401 004	Elective I	3		2	30	50		70	150
401 005	Elective II	3			30			70	100
401 006	Project Phase I	--	2			50			50
	Total →	16	2	8	150	150	100	350	750

Subject code	Subject	Semester – II							
		Teaching Scheme Hrs/Week			Examination Scheme				
		Lect	Tu	Pr	In-Semester Assessment	TW	Or	End - Semester Exam	Total
401 007	Dams and Hydraulic Structures	3	--	2	30	---	50	70	150
401 008	Quantity Surveying, Contracts and Tenders	3	--	2	30	--	50	70	150
401 009	Elective III	3	--	2	30	50	--	70	150
401 010	Elective IV	3	--	2	30	50	--	70	150
401 006	Project	--	6		--	50	100	--	150
	Total →	12	6	8	120	150	200	280	750

Following will be the list of electives..

Semester I

Elective-I 401 004 1. Structural Design of Bridges 2. Systems Approach in Civil Engineering 3.. Advanced Concrete Technology 4. Architecture and Town Planning 5. Advanced Engineering Geology with Rock Mechanics	Elective-II 401 005 1. Matrix Methods of Structural Analysis 2. Integrated Water Resources and Planning 3. TQM & MIS in Civil Engineering 4. Earthquake Engineering 5. Advanced Geotechnical Engineering
---	--

Semester II

Elective-III 401 009 1. Advanced Structural Design 2. Advanced Foundation Engineering 3. Hydropower Engineering 4. Air Pollution and control 5. Finite Element Method in Civil Engineering	Elective-IV 401 010 1 Construction Management 2. Advanced Transportation Engineering 3. Statistical Analysis and Computational Methods in Civil Engineering 4. Open Elective a). Plumbing Engineering b) Green Building Technology c) Ferrocement Technology d) Sub sea Engineering e) Wave Mechanics
---	--

I Semester

401 001 Environmental Engineering – II

Teaching Scheme: Lectures: 3 Hrs / week
Practical: 2 Hrs/week

Examination Scheme:
Paper In-sem. 30 Marks (1 hr),
Paper End-sem : 70 Marks (2.5 hr)
Oral : 50 Marks

Unit I

(6Hrs)

Sewage quantity: Collection and conveyance of sewage, sources of sewage, variations in sewage flow, Flow quantity estimation, Design of circular sanitary sewers. Pumping of sewage, necessity, location. Effect of change of life style on sewage quality.

Characteristics of sewage: Physical, chemical and biological characteristics, effluent discharge standards as per CPCB norms, interpretation and practical significance of test results.

Stream sanitation: Self purification of natural streams, river classification as per MoEF & CC,

Govt. of India; Oxygen Sag Curve, Streeter - Phelps equation and terminology (without derivation and numerical).

Unit II

(6Hrs)

Sewage treatment: Introduction to sewage treatment, preliminary, primary, secondary and tertiary treatment, Process flow diagram for sewage treatment, Theory and design of screen chamber, Grit Chamber and Primary sedimentation tank as per the Manual of CPHEEO.

Unit III

(6Hrs)

Theory & design of secondary treatment units: Introduction to unit operations and processes for secondary treatment. Principles of biological treatments, important microorganisms in waste water & their importance in waste water treatment systems, bacterial growth, general growth pattern, growth in terms of bacterial numbers and bacterial mass. Kinetics of biological growth, cell growth, substrate limited growth, cell growth and substrate utilization, effect of endogenous metabolism.

Activated sludge process: Theory and design of ASP, sludge volume index, sludge bulking & control, modifications in ASP.

Trickling filter: Biological principle, different T.F media & their characteristics, design of standard rate and high rate filters using NRC formula, single stage & two stage filters, recirculation, ventilation, operational problems, control measures, theory of rotating biological contractors.

Unit IV

(6Hrs)

Low cost treatment methods:

Oxidation pond: Bacteria – algae symbiosis, design of oxidation pond as per the manual of CPHEEO, advantages & disadvantages of oxidation ponds.

Aerated lagoons: Principle, aeration method, advantages & disadvantages of aerated Lagoons, design of aerated lagoon.
Introduction and theory of Phytoremediation technology for wastewater treatment.
Introduction and theory of root zone cleaning system

Unit V

(6Hrs)

Onsite Sanitation and Introduction to Package Sewage Treatment Plant: Working principle, advantages and disadvantages

Anaerobic digester: Principle of anaerobic digestion, stages of digestion, bio – gas production its characteristics & application, factors governing anaerobic digestion,. Dewatering of sludge by gravity thickener, sludge drying bed, decanters. Methods of sludge treatment and disposal, advantages & disadvantages. Up-flow Anaerobic Sludge Blanket (UASB) Reactor– Principle, advantages & disadvantages.

Unit VI

(6 Hrs)

Industrial waste water treatment: Methods of sampling. Equalization and neutralization. Application of preliminary, primary and secondary treatment for industrial wastewater as per the CPCB norms.

Sources of waste water generation from manufacturing process, characteristics of effluent, different methods of treatment & disposal of effluent for the following industries: Sugar, dairy and distillery. Discharge standards as per CPCB norms.

Term Work

A. Compulsory Assignment

1. Brief report on Sewer materials, choice of materials, testing of sewer pipes, sewer appurtenances.
2. Design of septic tank

B. Experiments

The term work shall consist of a journal giving details of at least 8 out of 12 of the following experiments conducted in Environmental Engineering laboratory, of which, **Sr.No.12 is compulsory.**

1. Solids -Total solids, suspended solids, volatile solids, settleable solids & non settleable solids.
2. Sludge Volume Index.
3. Dissolved oxygen.
4. Bio-Chemical Oxygen Demand.
5. Chemical Oxygen Demand.
6. Electrical Conductivity.
7. Determination of Phosphates by spectrophotometer.
8. Determination of Nitrates by spectrophotometer.
9. Determination of heavy metals like Cr⁶⁺ or Zn or Ni or Cd.
10. Determination of total nitrogen by kjeldal method
11. Visit to domestic / Industrial wastewater treatment plant & its detailed reports.

12. Computer aided design of Sewage Treatment Plant (STP) OR Effluent Treatment Plant (ETP) of Sugar or Dairy Industry using suitable software (C programming or any other suitable software).

Note: - Term Work should include a detailed analysis of practical interpretation, significance and application of test results.

Text Books

1. Environmental studies by Rajgopalan- Oxford University Press.
2. Waste Water Treatment & Disposal – Metcalf & Eddy - TMH publication.
3. Environmental Engg. - Peavy, Rowe - McGraw Hill Publication.
4. Waste Water Treatment – Rao & Dutta.

Reference Books

5. Waste Water Engg. – B.C. Punmia & Ashok Jain - Arihant Publications.
6. Water Supply & Waste Water Engg.- B.S.N. Raju – TMH publication.
7. Sewage Disposal & Air Pollution Engg. – S. K. Garg – Khanna Publication.
8. Environmental Engg. – Davis - McGraw Hill Publication
9. Manual on sewerage and sewage treatment – Public Health Dept., Govt. of India.
10. Standard Methods by APHA.

I.S. Codes

I.S. 3025 (all parts)

e - Resources

- i) <http://nptel.iitm.ac.in/courses-contents/IIT Kanpur and IIT Madras>.
- ii) <http://cpcb.nic.in>
- iii) <http://moef.nic.in>

@@

401 002 Transportation Engineering

Teaching scheme

Lectures: 3 hours/week

Practical: 2 hrs

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Term Work: 50 marks

Highway Engineering

Unit I

(6

hrs)

Introduction:

Role of transportation, scope of road transportation, highway development in India, necessity of highway planning and development plans e.g. Bombay plan, Lucknow plan.

Classification of road:

Classification of roads, road patterns, planning surveys and preparation of master plan based on saturation system, determination of road length by 3rd road development plan.

Traffic engineering:

Traffic characteristics-road user characteristics, vehicular characteristics (only name and significance) Traffic studies –name of various studies and their uses, accident studies-objectives, causes of accident, condition and collision diagram, and measures for the reduction in accidents. Traffic regulation and control devices-traffic signs, traffic signals (types merits and demerits) road markings. Traffic islands, types of road intersections (sketch merits and demerits). Parking facilities.

Unit II

(6

hrs)

Highway alignment:

Basic requirements of an ideal alignment and factors controlling it, engineering survey for highway location, special requirements for hill roads,

Geometric design and traffic engineering:

Design controls and criteria for geometric design, cross sectional elements, sight distance requirements, stopping distance, overtaking sight distance, overtaking zones with IRC recommendations, attainment of super elevation, radius of curves, methods of introduction of extra widening, widening of pavement on horizontal curves, horizontal transition curves-objects, necessity, types of transition curves, length and shift of transition curves. Design of vertical alignment, gradient and its type, IRC recommendations, grade compensation on horizontal curve, vertical curves: - crest and sag curves, types of summit curves, length of summit curve for SSD and OSD. Requirements, types of valley curves, length of valley curve for comfort and head light sight distance criteria.

Highway drainage:

Importance of highway drainage, subsurface and surface drainage systems, scope of arboriculture for highway.

Unit III

(6

hrs)

Highway materials:

Importance and properties of sub-grade, pavement component materials. Tests on aggregates. Bitumen: Types--cut back, tar, emulsion and tests, modified binders, bitumen mix design by Marshall Stability test, viscosity based gradation of bitumen

Pavement design:

Objects and requirements, types of pavements structures, functions of pavement components factors affecting pavement design, Design of flexible pavement by C.B.R. Method, IRC 37- guidelines design of rigid pavements, factors affecting design & analysis of stress- wheel load stress & temp. Stress, critical combination of stress, IRC 58- design guidelines, types of joints, requirements of joints.

Construction:

Construction process of WBM, WMM, GSB (Mix design). Introduction to bituminous works such as prime coat, tack coat, seal coat, MPM, AC or BC, BM, DBM and premix carpet.

II Semester

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 007 Dams and Hydraulic Structures

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
Insem : 30 marks (1Hour)
Endsem:70 marks (2.5.Hours)
Oral : 50 marks

Unit I

Chapter 1. Introduction to dams [2 Lectures]

Introduction, Historical development of dams, Different terms related to dams, Selection of site for dam, Factors governing selection of type of dam, Classification of dams, Classification based on purpose, Classification based on materials, Classification based on size of project, Classification based on hydraulic action, Classification based on structural action, Dams and earthquakes, Dams and social issues, Large dams verses small dams, Displacement and rehabilitation, Dams and climate change

Chapter 2. Dam Safety and Instrumentation [2 Lectures]

Introduction, Objectives of dam safety and instrumentation, Types of measurements, Instrumentation data system, Working principles of instruments, Selection of Equipments, Different Instruments, Piezometers, Porous tube piezometer (Determination of uplift pressure), Pneumatic piezometer (Determination of ground water pressure), Vibrating wire piezometer (Determination of pore water pressure) ,Settlement measurement system Vibrating wire settlement cell (Determination of settlement of earth dam embankments) Magnetic settlement system (Determination of settlement and lateral movements) Inclinator (Determination of shear plane and lateral movements) ,Jointmeter (Determination of movement of joints),Pendulums (Determination of tilt and rotation) ,Inverted Pendulum, Hanging Pendulum, Automatic pendulum coordinator ,Vibrating wire pressure cell (Determination of total pressure and stress distribution), Extensometer (Determination of internal deformation and cracking), Embedment strain gauge (Determination of internal strain), Temperature gauge (Determination of temperature),Distributed fiber optics temperature tool, Seismograph (Determination of earthquake shaking)

UNIT 2

Chapter 3. Gravity Dams [6 Lectures]

Introduction, Components of gravity dam, Conditions favoring gravity dams, Forces acting on gravity dam, Combinations of loading for design, Seismic analysis of dam, Terms related

to seismic analysis, Determination of Seismic forces, Effect of horizontal earthquake acceleration, Effect of vertical earthquake acceleration, Stress analysis in gravity dam (Only concept, no derivations), Vertical or normal stress, Principal stresses, Shear stress, Middle third rule, Modes of failure of gravity dam, Elementary profile of gravity dam, Concept of low and high gravity dams, Various Design methods of gravity dam (Introduction only)—Details of Gravity method or 2 D method, Construction of gravity dams, Colgrout masonry, Roller Compacted Concrete (R.C.C.), Temperature control in mass concreting, Crack formation in gravity dam, Control of crack formation in dams, Construction joints, Keys, Water seal, Retrofitting.

Chapter 4. Arch Dam and Other Dams (Introduction only) [2 Lectures]

Introduction, Concept of Arch Dam, Conditions favoring an arch dam, Classification of an arch dam, Constant angle arch dam, Constant radius arch dam, Variable radius arch dam, Arch gravity dam, Double curvature arch dam, Buttress dams, Advantages of Buttress dams, Limitations of Buttress dams, Types of buttress dams.

Unit III

Chapter 5. Spillway and Gates [6 Lectures]

Introduction, Location of Spillway, Different key levels and heads in spillway, Spillway Capacity, Components of spillway, Approach channel, Control structure, Discharge channel, Energy dissipation device, Tail channel, Classification of spillway, Classification based on operation, Main or service spillway, Auxiliary spillway, Emergency spillway, Classification based on gates, Gated spillway, Ungated spillway, Classification based on features, Straight drop spillway (Free overflow spillway), Saddle spillway, Side channel spillway, Overflow or ogee spillway, Chute or open channel or trough spillway, Shaft or morning glory spillway, Siphon spillway, Conduit or tunnel spillway, Stepped spillway, Design of Ogee spillway or overflow spillway, Shape of crest, Equations for spillway profile on upstream and downstream, Energy dissipation below spillway, Classification of energy dissipation devices, Energy dissipation in stilling basin, Stilling basin, Components of stilling basin, Types of stilling basins, Indian standard stilling basins, Energy dissipation through buckets, Solid roller bucket, Slotted roller bucket, Ski jump bucket, Correlation between jump height and tail water depth, Correlation 1-2-3-4-5 of TWD Vs Jump depth. Spillway gates, Classification of spillway crest gates, Classification based on function, Classification based on movement of gates, Classification based on special features, Requirements of spillway gates, Maintenance of gates, Inspection of gates,

Chapter 6 : Hydropower Structures [2 Lectures]

Introduction to hydropower, Advantages and limitations of hydropower, Assessment of hydropower potential, Definition and different terms related to hydropower, Features of layout of hydropower plant, Classification of hydropower plants based on storage, functions, head, plant capacity, location, nature of project.

Unit IV

Chapter 7. Earth Dam [6]

Introduction, Conditions favoring an earth dam, Limitations of earth dam, Classification of earth dam, Classification based on—materials, method of construction, height; Selection of type of earth dam, Components of an earth dam, Requirements for safe design of earth dam, Hydraulic (Seepage) Analysis, Plotting of seepage line, Case 1: Homogeneous earth dam with horizontal drainage blanket, Determination of seepage discharge using phreatic line.

Case II: Composite earth dam with casing and hearting, Properties of phreatic line, Determination of seepage discharge through earth dam using flownet, Structural stability analysis of homogeneous and zoned earth dam, Forces acting on earth dam, Method of stability analysis of an earth dam, Procedure of analysis by Swedish slip circle method, Fellenius Method of Locating Centre of Critical Slip circle, Stability analysis for foundation, Failure of earth dam, Classification of failure of earth dams, Hydraulic Failure, Seepage failure, Structural failure, Other failures, Seepage control in earth dams, causes of seepage, Seepage control measures, Construction of earth dam,

Chapter 8. Diversion head works [5 Lectures]

Introduction, Function of diversion headworks, Selection of site for diversion headworks, Layout of diversion headworks, Components of diversion headworks, Design of weir on permeable foundation, Criteria for safe design of weir floor, Brief introduction to Bligh and Lane's theory, Khosla's theory based on potential theory approach, Khosla's theory of independent variables, Design criteria of weirs on permeable foundations, Checks for stability and safety of weirs

Unit V

Chapter 9.-Canals [4 Lectures]

Introduction, Classification of canals, Classification based on alignment, Classification based on soil, Classification based on source of supply, Classification based on discharge, Classification based on lining, Classification based on excavation, Components of canal , Data required for canal design, Selection of canal alignment, Design of stable canal in alluvial beds, Kennedy's theory, Design of canal by Kennedy's theory, Limitations of Kennedy's theory, Lacey's regime theory, Design of canal by Lacey's theory, Canal lining, Need of canal lining, Requirements of lining material, Classification of canal lining, Hard surface lining including Ferrocement lining, Soft surface lining, Burried lining, Advantages of canal lining, Design of lined canal, Benefit – cost analysis for canal lining,

Chapter 10 –Canal Structures[2 Lectures]

Canal falls Introduction, Necessity of canal fall, Selection of site for canal fall, Classification of canal fall, Types of falls, Free fall or open fall, Notch fall, Ogee Fall, Rapid Stepped fall, Straight glacis fall, Sarda fall, Semi pressure fall, Baffle or Englis Fall, Montague fall Siphon well or cylinder fall, Pressure or closed conduit fall, Shaft or Pipe fall, Selection of type of fall, **Canal outlets-** Introduction of Canal outlet or module, **Canal escapes-** Introduction of Escapes, Significance of canal escape, **Canal regulators--**Canal regulators,

Unit VI

Chapter 11 C. D. Works [3 Lectures]

Introduction, Necessity of cross drainage works, Selection of site for Cross Drainage work, Data required for design of Cross Drainage work, Classification of Cross Drainage works, Drain over canal-Siphon,Super passage, Canal over drain—Aqueduct, Siphon aqueduct,Canal and drain water mixed in each other--Level crossing,Inlet and Outlet, Selection of suitable type of C. D. works, Design considerations for cross drainage works.

Chapter 12- River Training Structures [2 Lectures]

Introduction, Classification of rivers, Classification based on topography, regime, alignment, source, Behaviour of rivers, River training, Objectives of river training, Classification of river training, purpose, orientation, River training structures, Embankment or Levee, Guide banks, Groynes or spurs, Artificial cut off, Pitched island, Submerged sill or dykes, Closing dykes.

Term Work (A+B+C)

A) Analysis /Design Assignments

- 1) Stability analysis of gravity dam
- 2) Design of profile of spillway and energy dissipation device below the spillway
- 3) Stability analysis of zoned earthen dam
- 4) Analysis of weirs on permeable foundations.
- 5) Design of lined canal

B) Any 3 actual site visits and reports with photographs out of following 4 ---

- 6) Visit report on Gravity dam
- 7) Visit report on Earth dam
- 8) Visit report on C.D.work
- 9) Visit report on Canal structure(s)

C)) Review of any one case study of failure of hydraulic structure from the published literature

Note-Visit report should consist of Name of project, date of visit , need and practical significance of project, salient features of project, technical details of project, detailed description and figures of different components of project, special features of project, the technical, social, financial and environmental impact of project on downstream and upstream, photographs of technical details of visit, if allowed . If not allowed for technical details, the photograph near board of project or site as a proof of visit.

Reference Books :-----

1. Design of Small Dams- United States Department of the Interior, Bureau of Reclamation revised reprint 1974, Oxford and IBH Publishing Co.
2. Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, first ed, 2005.
3. Engineering for Dams- Creager W.P, Justin J.D, Hinds J -Wiley Eastern Pvt. Ltd., New Delhi, 1968
4. Irrigation Engineering and Hydraulic Structures- Garg S.K- Khanna Publishers N.D. 13th ed, 1998.
5. Hydraulic Structures, Vol. 1. & Vol. 2- Grishin M.M- Mir Publishers, Moscow, 1982.
6. Design Textbook in Civil Engineering: Volume Six: Dams- Leliavsky, Serge – Oxford and IBH Publishing Co. Pvt. Ltd., 1981.
7. Roller Compacted Concrete Dams- Mehrotra V.K- Standard Publishers Distributors, Delhi, 1st ed, 2004.
8. Irrigation, Water Resources and Water Power Engineering- Modi, P.N. - Standard Book House, New Delhi, 2nd ed, 1990.
9. Earth and Earth Rock Dams- Sherard J.L, Woodward R.J. - John Wiley and Sons, inc. 1963.

I.S. Codes

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)

401 008 Quantity Surveying, Contracts and Tenders

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
Insem : 30 marks (1Hour)
Endsem: 70 marks (2.5.Hours)
Oral : 50 marks

Unit I

Introduction and Approximate Estimates [6 Lectures]

a) Introduction to estimates and related terms: Definitions of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Civil Engineering projects. Units of measurement. Mode of measurement of building items/ works. Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum & prime cost items, contingencies, work charge establishment, centage charges. Introduction to D. S. R

b) Approximate Estimates: Meaning, purpose, methods of approximate estimation of building & other civil engineering projects like roads, irrigation/ water supply, sanitary engineering, electrical works.

Unit-II

Taking out quantities & Detailed estimate up to plinth [6 Lectures]

a) Methods of estimating-P.W.D. and center-line methods of working out quantities. Calculation of quantities for Load bearing and R.C.C framed structures up to plinth,

b) Detailed estimates, Factors to be considered while Preparing Detailed Estimate, Detailed estimates of Load bearing and R.C.C framed structures up to plinth only.

Unit-III

Detailed Estimation for super structure & Valuation [6 Lectures]

a) Calculation of quantities and detailed estimate for Load bearing and framed structures above plinth (super structure). Deduction rules for different items of work as per IS: 1200.

b) Valuation: Purpose of valuation. Meaning of price, cost and value. Factors affecting 'value'. Types of value: only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Concept of free hold and lease hold property. Estimation versus valuation. Meanings of depreciation & obsolescence.

Unit IV

Specifications and Rate Analysis [6 Lectures]

a) Specifications: Meaning & purpose, types. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work.

b) Rate Analysis: Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Working out Rate Analysis for the items mentioned in specifications above. Task work or out turn, factors effecting task work.

Unit V

Tendering and Execution of Works [6 Lectures]

a) Tenders: Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, Pre-bid conference, acceptance/ rejection of tenders. Various forms of BOT & Global Tendering, E-tendering.

b) Methods of Executing Works: PWD procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD.

Unit V

Contracts and Arbitration [6 Lectures]

a) Contracts: Definition, objectives & essentials of a valid contract as per Indian Contract Act(1872), termination of contract. Types of contracts: only lump sum, item rate, cost plus. **Conditions of contract:** General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final bill.

b) Arbitration: Introduction to Arbitrations as per Indian Arbitration & Conciliation Act (1996) Meaning and need of arbitration, qualities and powers of an Arbitrator,

c) Brief introduction to laws related to professional liabilities

Term Work

The following exercises should be prepared and submitted:

1. Working out quantities using C-L and PWD method for a small single storied load bearing structure and working out cost of building using DSR(Regional)
2. Working out quantities of steel reinforcement for a column footing, a column, a beam and a slab by preparing bar bending schedule.
3. Detailed estimate of a single storied R. C. C. framed building using D.S.R.
4. Estimating quantities for any one of the following: a) A factory shed of steel frame
b) Underground Water Tank c) Pipe Culvert, d) Road/Railway track/Runway
5. Drafting detailed specifications of any 2 items of building & analyzing their rates based on prevailing market.
6. Drafting of tender notice and collecting minimum 3 tender notices of Civil Engineering works.

. Home assignment on the following is compulsory

7. Preparation of tender documents for the problem No.1 or 3
 - a) Tender Notice.
 - b) Schedule A and Schedule B
 - c) Conditions of contracts regarding time, labour payment, damages
8. Report on contents and use of current DSR.

Note: Any one of the above to be completed using a suitable (relevant) software.

Oral Examination: Based on the Term Work Written Examinations:

Question Paper shall be based on the portions completed in theory lectures as well as in the Practical Sessions.

Reference Books

1. Estimating and Costing in Civil Engineering: Theory and Practice: B.N Dutta - S. Dutta&Company, Lucknow.
 2. Estimating, Costing Specifications & valuation in Civil Engineering: M. Chakraborty.
 3. Estimating and Costing: R. C. Rangwala - Charotar Publ. House, Anand
 4. Theory and Practice of Valuation: Dr. RoshanNamavati, Lakhani Publications
 5. Valuation Principles and Procedures: Ashok Nain, Dewpoint Publ.
 6. Laws for Engineers : Dr. Vandana Bhat and PriyankaVyas –Published by PRO-CARE,5/B,/Sagarika Society,Juhu Tara Road,Juhu,Santacruz(W),Mumbai-400049 (procure@technolegal.org)
-

Handbooks

1. Standard Contract Clauses for Domestic Bidding Contracts: Ministry of Statistics and Programme Implementation, Government of India.
 2. FIDIC Document: Federation International Des IngenieursConseils i.e. International Federation of Consulting Civil Engineers, Geneva, Switzerland.
 3. Indian Practical Civil Engineers' Handbook: P. N. Khanna, UBS Publi. Distri. Pvt. Ltd. (UBSDP)
-

Codes

1. IS 1200 (Part 1 to 25): Methods of Measurement of Building & Civil Engg. Works.
2. IS 3861-1966: Method of Measurement of Areas and Cubical Contents of buildings.
3. D. S. R. (District Schedule of Rates) for current year.
4. PWD Redbooks, Vol 1 & 2.

e – Resources: nptel.iitm.ac.in

401 002 Transportation Engineering

Teaching scheme

Lectures: 3 hours/week

Practical: 2 hrs

Examination scheme

In semester exam: 30 marks---1 hour

End semester exam: 70 marks—2.5 hours

Term Work: 50 marks

Highway Engineering

Unit I

(6

hrs)

Introduction:

Role of transportation, scope of road transportation, highway development in India, necessity of highway planning and development plans e.g. Bombay plan, Lucknow plan.

Classification of road:

Classification of roads, road patterns, planning surveys and preparation of master plan based on saturation system, determination of road length by 3rd road development plan.

Traffic engineering:

Traffic characteristics-road user characteristics, vehicular characteristics (only name and significance) Traffic studies –name of various studies and their uses, accident studies-objectives, causes of accident, condition and collision diagram, and measures for the reduction in accidents. Traffic regulation and control devices-traffic signs, traffic signals (types merits and demerits) road markings. Traffic islands, types of road intersections (sketch merits and demerits). Parking facilities.

Unit II

(6

hrs)

Highway alignment:

Basic requirements of an ideal alignment and factors controlling it, engineering survey for highway location, special requirements for hill roads,

Geometric design and traffic engineering:

Design controls and criteria for geometric design, cross sectional elements, sight distance requirements, stopping distance, overtaking sight distance, overtaking zones with IRC recommendations, attainment of super elevation, radius of curves, methods of introduction of extra widening, widening of pavement on horizontal curves, horizontal transition curves-objects, necessity, types of transition curves, length and shift of transition curves. Design of vertical alignment, gradient and its type, IRC recommendations, grade compensation on horizontal curve, vertical curves: - crest and sag curves, types of summit curves, length of summit curve for SSD and OSD. Requirements, types of valley curves, length of valley curve for comfort and head light sight distance criteria.

Highway drainage:

Importance of highway drainage, subsurface and surface drainage systems, scope of arboriculture for highway.

Unit III

(6

hrs)

Highway materials:

Importance and properties of sub-grade, pavement component materials. Tests on aggregates. Bitumen: Types--cut back, tar, emulsion and tests, modified binders, bitumen mix design by Marshall Stability test, viscosity based gradation of bitumen

Pavement design:

Objects and requirements, types of pavements structures, functions of pavement components factors affecting pavement design, Design of flexible pavement by C.B.R. Method, IRC 37- guidelines design of rigid pavements, factors affecting design & analysis of stress- wheel load stress & temp. Stress, critical combination of stress, IRC 58- design guidelines, types of joints, requirements of joints.

Construction:

Construction process of WBM, WMM, GSB (Mix design). Introduction to bituminous works such as prime coat, tack coat, seal coat, MPM, AC or BC, BM, DBM and premix carpet.

II Semester

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)
401 007 Dams and Hydraulic Structures

Teaching Scheme

Lectures: 3 hours/week
Practical: 2 hours/week

Examination Scheme

Theory Examination:
Insem : 30 marks (1Hour)
Endsem:70 marks (2.5.Hours)
Oral : 50 marks

Unit I

Chapter 1. Introduction to dams [2 Lectures]

Introduction, Historical development of dams, Different terms related to dams, Selection of site for dam, Factors governing selection of type of dam, Classification of dams, Classification based on purpose, Classification based on materials, Classification based on size of project, Classification based on hydraulic action, Classification based on structural action, Dams and earthquakes, Dams and social issues, Large dams verses small dams, Displacement and rehabilitation, Dams and climate change

Chapter 2. Dam Safety and Instrumentation [2 Lectures]

Introduction, Objectives of dam safety and instrumentation, Types of measurements, Instrumentation data system, Working principles of instruments, Selection of Equipments, Different Instruments, Piezometers, Porous tube piezometer (Determination of uplift pressure), Pneumatic piezometer (Determination of ground water pressure), Vibrating wire piezometer (Determination of pore water pressure) ,Settlement measurement system Vibrating wire settlement cell (Determination of settlement of earth dam embankments) Magnetic settlement system (Determination of settlement and lateral movements) Inclinator (Determination of shear plane and lateral movements) ,Jointmeter (Determination of movement of joints),Pendulums (Determination of tilt and rotation) ,Inverted Pendulum, Hanging Pendulum, Automatic pendulum coordinator ,Vibrating wire pressure cell (Determination of total pressure and stress distribution), Extensometer (Determination of internal deformation and cracking), Embedment strain gauge (Determination of internal strain), Temperature gauge (Determination of temperature),Distributed fiber optics temperature tool, Seismograph (Determination of earthquake shaking)

UNIT 2

Chapter 3. Gravity Dams [6 Lectures]

Introduction, Components of gravity dam, Conditions favoring gravity dams, Forces acting on gravity dam, Combinations of loading for design, Seismic analysis of dam, Terms related

to seismic analysis, Determination of Seismic forces, Effect of horizontal earthquake acceleration, Effect of vertical earthquake acceleration, Stress analysis in gravity dam (Only concept, no derivations), Vertical or normal stress, Principal stresses, Shear stress, Middle third rule, Modes of failure of gravity dam, Elementary profile of gravity dam, Concept of low and high gravity dams, Various Design methods of gravity dam (Introduction only)—Details of Gravity method or 2 D method, Construction of gravity dams, Colgrout masonry, Roller Compacted Concrete (R.C.C.), Temperature control in mass concreting, Crack formation in gravity dam, Control of crack formation in dams, Construction joints, Keys, Water seal, Retrofitting.

Chapter 4. Arch Dam and Other Dams (Introduction only) [2 Lectures]

Introduction, Concept of Arch Dam, Conditions favoring an arch dam, Classification of an arch dam, Constant angle arch dam, Constant radius arch dam, Variable radius arch dam, Arch gravity dam, Double curvature arch dam, Buttress dams, Advantages of Buttress dams, Limitations of Buttress dams, Types of buttress dams.

Unit III

Chapter 5. Spillway and Gates [6 Lectures]

Introduction, Location of Spillway, Different key levels and heads in spillway, Spillway Capacity, Components of spillway, Approach channel, Control structure, Discharge channel, Energy dissipation device, Tail channel, Classification of spillway, Classification based on operation, Main or service spillway, Auxiliary spillway, Emergency spillway, Classification based on gates, Gated spillway, Ungated spillway, Classification based on features, Straight drop spillway (Free overflow spillway), Saddle spillway, Side channel spillway, Overflow or ogee spillway, Chute or open channel or trough spillway, Shaft or morning glory spillway, Siphon spillway, Conduit or tunnel spillway, Stepped spillway, Design of Ogee spillway or overflow spillway, Shape of crest, Equations for spillway profile on upstream and downstream, Energy dissipation below spillway, Classification of energy dissipation devices, Energy dissipation in stilling basin, Stilling basin, Components of stilling basin, Types of stilling basins, Indian standard stilling basins, Energy dissipation through buckets, Solid roller bucket, Slotted roller bucket, Ski jump bucket, Correlation between jump height and tail water depth, Correlation 1-2-3-4-5 of TWD Vs Jump depth. Spillway gates, Classification of spillway crest gates, Classification based on function, Classification based on movement of gates, Classification based on special features, Requirements of spillway gates, Maintenance of gates, Inspection of gates,

Chapter 6 : Hydropower Structures [2 Lectures]

Introduction to hydropower, Advantages and limitations of hydropower, Assessment of hydropower potential, Definition and different terms related to hydropower, Features of layout of hydropower plant, Classification of hydropower plants based on storage, functions, head, plant capacity, location, nature of project.

Unit IV

Chapter 7. Earth Dam [6]

Introduction, Conditions favoring an earth dam, Limitations of earth dam, Classification of earth dam, Classification based on—materials, method of construction, height; Selection of type of earth dam, Components of an earth dam, Requirements for safe design of earth dam, Hydraulic (Seepage) Analysis, Plotting of seepage line, Case 1: Homogeneous earth dam with horizontal drainage blanket, Determination of seepage discharge using phreatic line.

Case II: Composite earth dam with casing and hearting, Properties of phreatic line, Determination of seepage discharge through earth dam using flownet, Structural stability analysis of homogeneous and zoned earth dam, Forces acting on earth dam, Method of stability analysis of an earth dam, Procedure of analysis by Swedish slip circle method, Fellenius Method of Locating Centre of Critical Slip circle, Stability analysis for foundation, Failure of earth dam, Classification of failure of earth dams, Hydraulic Failure, Seepage failure, Structural failure, Other failures, Seepage control in earth dams, causes of seepage, Seepage control measures, Construction of earth dam,

Chapter 8. Diversion head works [5 Lectures]

Introduction, Function of diversion headworks, Selection of site for diversion headworks, Layout of diversion headworks, Components of diversion headworks, Design of weir on permeable foundation, Criteria for safe design of weir floor, Brief introduction to Bligh and Lane's theory, Khosla's theory based on potential theory approach, Khosla's theory of independent variables, Design criteria of weirs on permeable foundations, Checks for stability and safety of weirs

Unit V

Chapter 9.-Canals [4 Lectures]

Introduction, Classification of canals, Classification based on alignment, Classification based on soil, Classification based on source of supply, Classification based on discharge, Classification based on lining, Classification based on excavation, Components of canal , Data required for canal design, Selection of canal alignment, Design of stable canal in alluvial beds, Kennedy's theory, Design of canal by Kennedy's theory, Limitations of Kennedy's theory, Lacey's regime theory, Design of canal by Lacey's theory, Canal lining, Need of canal lining, Requirements of lining material, Classification of canal lining, Hard surface lining including Ferrocement lining, Soft surface lining, Burried lining, Advantages of canal lining, Design of lined canal, Benefit – cost analysis for canal lining,

Chapter 10 –Canal Structures[2 Lectures]

Canal falls Introduction, Necessity of canal fall, Selection of site for canal fall, Classification of canal fall, Types of falls, Free fall or open fall, Notch fall, Ogee Fall, Rapid Stepped fall, Straight glacis fall, Sarda fall, Semi pressure fall, Baffle or Englis Fall, Montague fall Siphon well or cylinder fall, Pressure or closed conduit fall, Shaft or Pipe fall, Selection of type of fall, **Canal outlets-** Introduction of Canal outlet or module, **Canal escapes-** Introduction of Escapes, Significance of canal escape, **Canal regulators--**Canal regulators,

Unit VI

Chapter 11 C. D. Works [3 Lectures]

Introduction, Necessity of cross drainage works, Selection of site for Cross Drainage work, Data required for design of Cross Drainage work, Classification of Cross Drainage works, Drain over canal-Siphon,Super passage, Canal over drain—Aqueduct, Siphon aqueduct,Canal and drain water mixed in each other--Level crossing,Inlet and Outlet, Selection of suitable type of C. D. works, Design considerations for cross drainage works.

Chapter 12- River Training Structures [2 Lectures]

Introduction, Classification of rivers, Classification based on topography, regime, alignment, source, Behaviour of rivers, River training, Objectives of river training, Classification of river training, purpose, orientation, River training structures, Embankment or Levee, Guide banks, Groynes or spurs, Artificial cut off, Pitched island, Submerged sill or dykes, Closing dykes.

Term Work (A+B+C)

A) Analysis /Design Assignments

- 1) Stability analysis of gravity dam
- 2) Design of profile of spillway and energy dissipation device below the spillway
- 3) Stability analysis of zoned earthen dam
- 4) Analysis of weirs on permeable foundations.
- 5) Design of lined canal

B) Any 3 actual site visits and reports with photographs out of following 4 ---

- 6) Visit report on Gravity dam
- 7) Visit report on Earth dam
- 8) Visit report on C.D.work
- 9) Visit report on Canal structure(s)

C)) Review of any one case study of failure of hydraulic structure from the published literature

Note-Visit report should consist of Name of project, date of visit , need and practical significance of project, salient features of project, technical details of project, detailed description and figures of different components of project, special features of project, the technical, social, financial and environmental impact of project on downstream and upstream, photographs of technical details of visit, if allowed . If not allowed for technical details, the photograph near board of project or site as a proof of visit.

Reference Books :-----

1. Design of Small Dams- United States Department of the Interior, Bureau of Reclamation revised reprint 1974, Oxford and IBH Publishing Co.
2. Irrigation and Water Resources Engineering- Asawa G.L- New Age International (P) Ltd. Publishers, first ed, 2005.
3. Engineering for Dams- Creager W.P, Justin J.D, Hinds J -Wiley Eastern Pvt. Ltd., New Delhi, 1968
4. Irrigation Engineering and Hydraulic Structures- Garg S.K- Khanna Publishers N.D. 13th ed, 1998.
5. Hydraulic Structures, Vol. 1. & Vol. 2- Grishin M.M- Mir Publishers, Moscow, 1982.
6. Design Textbook in Civil Engineering: Volume Six: Dams- Leliavsky, Serge – Oxford and IBH Publishing Co. Pvt. Ltd., 1981.
7. Roller Compacted Concrete Dams- Mehrotra V.K- Standard Publishers Distributors, Delhi, 1st ed, 2004.
8. Irrigation, Water Resources and Water Power Engineering- Modi, P.N. - Standard Book House, New Delhi, 2nd ed, 1990.
9. Earth and Earth Rock Dams- Sherard J.L, Woodward R.J. - John Wiley and Sons, inc. 1963.

I.S. Codes

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)

401 008 Quantity Surveying, Contracts and Tenders

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

Insem : 30 marks (1Hour)

Endsem: 70 marks (2.5.Hours)

Oral : 50 marks

Unit I

Introduction and Approximate Estimates [6 Lectures]

a) Introduction to estimates and related terms: Definitions of estimation and valuation. Significance (application) of the Course. Purpose of estimation. Type of estimates, data required for estimation as a pre requisite. Meaning of an item of work, and enlisting the items of work for different Civil Engineering projects. Units of measurement. Mode of measurement of building items/ works. Introduction to components of estimates: face sheet, abstract sheet (BOQ), measurement sheet, Rate Analysis, lead statement. Provisional sum & prime cost items, contingencies, work charge establishment, centage charges. Introduction to D. S. R

b) Approximate Estimates: Meaning, purpose, methods of approximate estimation of building & other civil engineering projects like roads, irrigation/ water supply, sanitary engineering, electrical works.

Unit-II

Taking out quantities & Detailed estimate up to plinth [6 Lectures]

a) Methods of estimating-P.W.D. and center-line methods of working out quantities. Calculation of quantities for Load bearing and R.C.C framed structures up to plinth,

b) Detailed estimates, Factors to be considered while Preparing Detailed Estimate, Detailed estimates of Load bearing and R.C.C framed structures up to plinth only.

Unit-III

Detailed Estimation for super structure & Valuation [6 Lectures]

a) Calculation of quantities and detailed estimate for Load bearing and framed structures above plinth (super structure). Deduction rules for different items of work as per IS: 1200.

b) Valuation: Purpose of valuation. Meaning of price, cost and value. Factors affecting 'value'. Types of value: only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Concept of free hold and lease hold property. Estimation versus valuation. Meanings of depreciation & obsolescence.

Unit IV

Specifications and Rate Analysis [6 Lectures]

a) Specifications: Meaning & purpose, types. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work.

b) Rate Analysis: Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Working out Rate Analysis for the items mentioned in specifications above. Task work or out turn, factors effecting task work.

Unit V

Tendering and Execution of Works [6 Lectures]

a) Tenders: Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, Pre-bid conference, acceptance/ rejection of tenders. Various forms of BOT & Global Tendering, E-tendering.

b) Methods of Executing Works: PWD procedure of work execution, administrative approval, budget provision, technical sanction. Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD.

Unit V

Contracts and Arbitration [6 Lectures]

a) Contracts: Definition, objectives & essentials of a valid contract as per Indian Contract Act(1872), termination of contract. Types of contracts: only lump sum, item rate, cost plus. **Conditions of contract:** General and Specific conditions. Conditions regarding EM, SD, and time as an essence of contract, conditions for addition, alteration, extra items, testing of materials, defective work, subletting, etc. Defect liability period, liquidated damages, retention money, interim payment or running account bills, advance payment, secured advance, final bill.

b) Arbitration: Introduction to Arbitrations as per Indian Arbitration & Conciliation Act (1996) Meaning and need of arbitration, qualities and powers of an Arbitrator,

c) Brief introduction to laws related to professional liabilities

Term Work

The following exercises should be prepared and submitted:

1. Working out quantities using C-L and PWD method for a small single storied load bearing structure and working out cost of building using DSR(Regional)
2. Working out quantities of steel reinforcement for a column footing, a column, a beam and a slab by preparing bar bending schedule.
3. Detailed estimate of a single storied R. C. C. framed building using D.S.R.
4. Estimating quantities for any one of the following: a) A factory shed of steel frame
b) Underground Water Tank c) Pipe Culvert, d) Road/Railway track/Runway
5. Drafting detailed specifications of any 2 items of building & analyzing their rates based on prevailing market.
6. Drafting of tender notice and collecting minimum 3 tender notices of Civil Engineering works.

. Home assignment on the following is compulsory

7. Preparation of tender documents for the problem No.1 or 3
 - a) Tender Notice.
 - b) Schedule A and Schedule B
 - c) Conditions of contracts regarding time, labour payment, damages
8. Report on contents and use of current DSR.

Note: Any one of the above to be completed using a suitable (relevant) software.

Oral Examination: Based on the Term Work Written Examinations:

Question Paper shall be based on the portions completed in theory lectures as well as in the Practical Sessions.

Reference Books

Savitribai Phule Pune University
Board of Studies in Civil Engineering
B.E. Civil 2012 Course (w.e.f. June 2015)

401 009 Elective III (4): Air Pollution and Control

Teaching Scheme

Lectures: 3 hours/week

Practical: 2 hours/week

Examination Scheme

Theory Examination:

In-sem : 30 marks (1 Hour)

End-sem: 70 marks (2.5.Hours)

Term work: 50 Mark

Unit I

(6 hrs)

Meteorological aspects: Zones of atmosphere, Scales of meteorology, Meteorological parameters, Temperature lapse rate, Plume behavior. Gaussian diffusion model for finding ground level concentration. Plume rise. Types of fuels, Emission Inventory and stack height determination per CPCB norms.

Unit II

(6 hrs)

Ambient Air sampling and analysis: Air pollution survey, basis and statistical considerations of sampling sites, devices and methods used for sampling gases and particulates. Stack emission monitoring for particulate and gaseous matter, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Ambient air quality monitoring as per the procedure laid down by CPCB. National Ambient Air Quality Standards (NAAQS) 2009.

Unit III

(6 hrs)

Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, changes in indoor air quality, control of indoor air pollutants and air cleaning systems. Odour pollution: Theory, sources, measurement and methods of control of odour pollution.

Unit IV

(6 hrs)

Control of air pollution: By process modification, change of raw materials, fuels, process equipment and process operation. Control of particulate matters. Working principle and design of control equipment as Settling chamber, Cyclone, Fabric filter and Electro static precipitator. Control of gaseous pollutants. Control of air pollution from automobiles.

Unit V

(6 hrs)

Land use planning: As a method of control. Economics of air pollution control: Cost/benefit ratio and optimization. Legislation and regulation: Air (Prevention and Control) Pollution Act, 1981. The Environment (Protection) Act 1986. Emission standards for stationary and mobile sources.

Savitribai Phule University of Pune
Third Year Civil Engineering
(2015 Course)

Semester I

Course Code	Course	Teaching Scheme hour/week			Semester Examination Scheme of marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	T W	OR	PR	Total	TH/TUT	PR/OR/TW
301001	Hydrology and water resource engineering.	03	--	02	30	70	--	50	--	150	04	01
301002	Infrastructure Engineering and Construction Techniques	03	--	--	30	70	--	--	--	100	04	--
301003	Structural Design-I	04	--	04	30	70	50	50	--	200	04	02
301004	Structural Analysis-II	04	--	--	30	70	--	--	--	100	04	--
301005	Fluid Mechanics-II	04	--	02	30	70	--	50	--	150	04	01
301006	Employability Skills development	--	--	02	--	--	50	--	--	50	--	01
Total		18	--	10	150	350	100	150		750	20	05

Semester II

Course Code	Course	Teaching Scheme hour/week			Semester Examination Scheme of marks						Credit	
		Theory	Tutorial	Practical	In-Sem	End-Sem	T W	OR	PR	Total	TH/TUT	PR/OR/TW
301007	Advanced Surveying	03	--	02	30	70	50	--	--	150	04	01
301008	Project Management and Engineering Economics	04	--	--	30	70	--	--	--	100	04	--
301009	Foundation Engineering	03	--	--	30	70	--	--	--	100	04	--
301010	Structural Design-II	04	--	04	30	70	50	50	--	200	04	02
301011	Environmental Engineering-I	04	--	02	30	70	--	--	50	150	04	01
301012	Seminar	--	--	01	--	--	--	50	--	50	--	01
Total		18	--	09	150	350	100	100	50	750	20	05

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017

301001 Hydrology and Water Resource Engineering

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Oral: 50 Marks

Unit – I

(06 hours)

Introduction to Hydrology:

Hydrological cycle, Application of hydrology

Precipitation:

Types of precipitation, measurement, Rain gauge network, Preparation of data-estimation of missing data, Consistency test, Presentation of rainfall data-mass rainfall curves, Hyetograph, Point rainfall, Moving average, Mean precipitation over an area- arithmetic mean method, Thiessen's polygon, isohyetal method, Concepts of depth-area-duration analysis, Frequency analysis - frequency of point rainfall and plotting position, Intensity-duration curves, Maximum Intensity-duration- frequency analysis

Abstractions of Precipitation: Intersection, Depression storage, Evaporation- Elementary concepts, factors affecting, Measurement of evaporation, Transpiration, Evapotranspiration- process and measurement, Infiltration –introduction, Infiltration capacity, Infiltrometer, Horton's method and infiltration indices

Stream Gauging:

Selection of site, various methods of discharge measurement (velocity-area method, dilution method, slope-area method), Advance techniques/equipments used in gauge discharge measurements such as Radar, Current meter, ADCP (Acoustic Doppler Current Profiler)

Unit – II

(06 hours)

Introduction to Irrigation:

Definition, Functions, Advantages and Necessity, Methods of Irrigation, Surface Irrigation, Subsurface Irrigation, Micro-Irrigation

Water Requirements of Crops:

Soil moisture and Crop water relationship, Factors governing Consumptive use of water, Principal Indian crops, their season and water requirement, Crop planning, Agricultural practices, Calculations of canal and reservoir capacities – duty, delta, irrigation efficiency

Assessment of Canal Revenue:

Various methods (Area basis or crop rate basis, volumetric basis, seasonal basis, composite rate basis, permanent basis or betterment levy basis)

Unit III

(06 hours)

Ground Water Hydrology:

Occurrences and distribution of ground water, Specific yield of aquifers, Movement of ground water, Darcy's law, Permeability, Safe yield of basin, Hydraulics of wells under steady flow condition in confined and unconfined aquifers, Specific capacity of well, Well Irrigation: Tube wells, Open wells and their construction

Unit – IV

(06 hours)

Runoff:

Introduction, Factors affecting runoff, Rainfall-Runoff relationships, Empirical Techniques to determine runoff, Runoff hydrograph- Introduction, Factors affecting Flood Hydrograph, Components of Hydrograph, Base flow separation, Effective rainfall, Unit hydrograph theory, S-curve hydrograph, uses and limitations of Unit Hydrograph

Floods:

Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Design floods

Unit – V

(06 hours)

Reservoir Planning: Introduction, Term related to reservoir planning (Yield, Reservoir planning and operation curves, Reservoir storage, Reservoir clearance), Investigation for reservoir planning, Significance of mass curve and demand curves, Applications of mass curve and demand curves, Fixation of reservoir capacity from annual inflow and outflow, Fixation of reservoir capacity using elevation capacity curve and dependable yield, Reservoir regulation, Flood routing- Graphical or I.S.D method, Trial and error method, Reservoir losses, Reservoir sedimentation- Phenomenon, Measures to control reservoir sedimentation, Density currents Significance of trap efficiency, Useful life of reservoir, Costs of reservoir, Apportionment of total cost, Use of facilities method, Equal apportionment method, Alternative justifiable expenditure method

Unit VI

(06 hours)

Water Management:

Distribution, Warabandi, Rotational water supply system, Participatory Irrigation Management, Cooperative water distribution systems, Introduction to auto weather station

Water Logging and Drainage:

The process of water logging, Causes of water logging, Effects of water logging, preventive and curative measures, Land drainage, Reclamation of water logged areas, Alkaline and saline lands.

Reference Books

1. Irrigation Engineering - S. K. Garg, Khanna Publishers
2. Irrigation, Water Resources and water power engineering- P. N. Modi, Standard Book House.
3. Irrigation and water power Engineering- Dr. Punmia and Dr. Pande, Standard Publisher
4. Elementary Engineering Hydrology- M.J.Deodhar-Pearson Education

5. Engineering Hydrology. –Ojha—Oxford University Press
6. Engineering hydrology – K. Subramanyam Tata McGraw Hill.
7. Hydrology- Principles, Analysis and Desin, Raghunath, New Age International
8. Irrigation Engineering-Raghunath--Wiley
9. Groundwater Hydrology, 3ed—Todd--Wiley
10. Applied Hydrology – Chow, Maidment, Mays, McGraw-Hill
11. Principles of Hydrology- Ward and Robinson, Tata McGraw Hill
12. Irrigation Engineering - Bharat Singh

Term Work

Assignments (Hydrology and Water Resources Engineering)

Term work will consist of a journal giving the detailed report on assignments performed and visit report. (**any 8**)

1. Analysis of rainfall data (Double mass curve technique/Missing rainfall data).
2. Marking catchment area on a topo-sheet and working out average annual precipitation and determining yield by various methods.
3. Analytical method of measurement of infiltration
4. Flood frequency studies assuming Gumbel's extreme value distribution.
5. Determination of peak flood discharge in a basin using unit hydrograph technique.
6. Determination of storage capacity of a reservoir using mass curve of inflow and outflow.
7. Application of HEC-RAS for Hydrologic routing.
8. Site visit to Meteorological station
9. Measurement of / video demonstration of evaporation by Pan Evaporimeter
10. Measurement of / video demonstration of infiltration by Infiltrometer

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017

301002 Infrastructure Engineering and Construction Techniques

Teaching scheme	Examination scheme
Lectures: 3 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit I - Infrastructure Engineering (06 hours)

a) Meaning and scope of Infrastructure Engineering: Scope of infrastructure engineering in national and global development, Forthcoming infrastructure projects at national and global level, Necessity, advantages and disadvantages of PPP (Public Private Partnership), Salient features of smart city , Bus rapid transit system.

b) Railways: Permanent way, Track structure of BG, Functions of rail, Standard rail, Tilting of rail, Coning of wheels, Types of sleepers, Fastenings, Ballast, Modern development in railways- metro rails, mono rails, bullet train.

Unit II- Railways (06 hours)

Rail joints, types, evil effects, remedial measures, Welding of rails, Short and long welded rails, Types of gradients, Curves, Grade compensation on curves, Alignment, Super elevation, Equilibrium cant, Equilibrium speed, Maximum permissible limits for cant, Cant deficiency, Cant excess, Speed on curves, Safe speed on curves using Indian railways formula only for fully transition curves, Concept of negative cant, Points, crossings and turnouts- functions, Components, elements of points, Types of crossings and turnouts, Track maintenance: Regular and Periodic. **(Site visit is recommended to learn this topic)**

Unit III - Construction Techniques (06 hours)

Necessity of mechanization, Dredging techniques, Use of barges, Dewatering techniques- Well Point system, Vacuum dewatering, Electro osmosis, Underwater drilling and blasting, Grouting methods in soft and hard soil, Diaphragm walls- purpose and construction methods, Prefabrication – applications, advantages and disadvantages.

Unit IV – Tunneling (06 hours)

Tunneling, functions & types of tunnel, Criteria for selection of size & shape of tunnels. Pilot tunnel, shaft, adit and portal, Needle beam, NATM, TBM & earth pressure balance method of tunneling in soft soil, Drilling & blasting method of tunneling including various operations like mucking, Drainage in tunneling- Pre drainage and permanent drainage, Ventilation in tunneling- temporary and permanent, Micro tunneling and trenchless tunneling.

Unit V- Docks & Harbors (06 hours)

Introduction, Requirements of harbors and ports, Classification of harbors with examples, Selection of site for harbor, Various components of ports, Break waters- types, comparison, design criteria , methods of construction, Tetra pod, Tri bar, Hexapod, Quay wall, Wet & dry dock, Floating dock, Wharves, Jetties, Types of fenders, Dolphins, Marin railway.

Unit VI - Construction Equipments**(06 hours)**

Dozers, Power shovels, Excavators, Loaders, Scrapers, Dumpers, Drag line, Clamp shell, Compactors, Pavers, Factors affecting performance, selection of equipment, Various types of hoists and cranes and selection, Boom placers, Simple numerical problems on cycle time and production rate, Economic maintenance & repair of construction equipment.

Reference books

1. Construction Planning Methods & Equipment: Puerifoy –Tata MC Graw Hill
2. Construction Equipments & its Management: S.C Sharma, Khanna Publication
3. Railway Engineering, 2/E by Chandra—Oxford University Press
4. Railway Track Engineering: J.S.Mundrey, Tata McGraw Hill
5. Harbour, Dock & Tunnel Engineering: R. Srinivasan
6. Dock & Harbour Engineering: Hasmukh P.Oza & Gautam H.Oza-Charoter Book Stall
7. Construction Project Scheduling & Control, 2ed—Mubarak--Wiley

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017
301006 Employability Skills Development

Teaching scheme	Examination scheme
Practical: 2 hours/week	Term Work: 50 Marks

How to handle this course? (02 hours)

This course has been introduced with the objective of enhancing the employability of the students through development of their skills. Following topics and their contents are expected to be explored through following 10 activities.

1. Expert lectures 2.Group discussions 3.Case study analysis 4.Group presentations 5.Company and corporate visits 6.Mock interviews and exercises 7.Demo presentations 8. Audio-video shows 9. Use of e-resources 10.Games.

The term work will consist of detailed report of any 8 out of above 10 activities. The activities which need to be performed in a group will have a group of not more than 6 students. However, the report for the term work will be prepared at individual level.

Unit I (02 hours)

a) What is Employability? What are Employability Skills? Focus on what skills do employers expect from graduates? Career planning with action plan.

Unit –II (02 hours)

b) Interpersonal Skills-Critical Thinking, Assertiveness, Decision Making, Problem Solving, Negotiation, Building Confidence, Time Management, Personal Presentation, Assertiveness, Negotiation, Avoiding Stress.

Unit –III (02 hours)

c) Presentation Skills-Presentation Skills What is a Presentation? Writing Your Presentation Coping with Nerves

Unit –IV (02 hours)

d) Communication Skills-Verbal Communication, Written Communication, Difference between C.V. Bio data and Resume

Unit –V (02 hours)

e) Commercial Awareness-Professional etiquettes and manners, Global negotiating and Persuading, Integrity. Global trends and statistics about civil engineering businesses.

Unit-VI**(02 hours)**

f) Personal skills-Leadership, Ability to work in a team, Conceptual ability, Subject Knowledge and competence, Analysing and investigating, Planning, Flexibility, Self, Lifelong Learning, Stress Tolerance, Creativity

Reference Reading

1. Cambridge English for Job Hunting—Colm Downes---Cambridge University Press (ISBN-978-0- 521-14470-4)
2. Polyskills--Foundation books-- Cambridge University Press—(ISBN 978-81-7596-916-2)
3. Global Business Foundation Skills-- Foundation books-- Cambridge University Press—(ISBN 978-81-7596-783-0)

E-Resources

www.skillsyouneed.com/general/employability-skills.html
www.kent.ac.uk/careers/sk/top-ten-skills.htm
www.skillsyouneed.com/general/employability-
www.fremont.k12.ca.us/cms/lib04/.../Domain/.../employability-skills.pdf

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017

301008 Project Management and Engineering Economics

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks---1 hour Paper
	End semester exam: 70 marks—2.5 hours Paper

Unit I **(8 hours)**

Introduction to project management

Importance, Objectives & Functions of Management , Principles of Management, Categories of Project, Project Failure, Project--- Life Cycle Concept and Cost Components, Project Management Book of Knowledge {PMBOK} – Different Domain Areas, Project management Institute and Certified Project Management Professionals (PMP). Importance of organizational Structure in Management- Authority / Responsibility Relation, Management by objectives (MBO)

Unit –II **(08 hours)**

Project planning and scheduling

WBS – Work Breakdown Structure, Gantt/Bar chart & its Limitations, Network Planning, Network analysis, C. P. M.- . Activity on Arrow (A.O.A.), Critical path and type of Floats, Precedence network analysis (A.O.N.), Types of precedence relationship, P. E. R.T. Analysis

Unit –III **(08 hours)**

Project Resources and Site Planning

Objectives of Materials Management – Primary and Secondary Material Procurement Procedures - Material requirement - raising of Indents, Receipts, Inspection, Storage, Delivery, Record keeping – Use of Excel Sheets, ERP Software, Inventory Control - ABC analysis, EOQ, Introduction to Equipment Management – Fleet Management, Productivity Studies, Equipment Down Time, Sizing - Matching , Site Layout and Planning, Safety Norms – Measures and Precautions on Site, Implementation of Safety Programs

Unit –IV **(08 hours)**

Project Monitoring and Control

Resource Allocation – Resource Smoothing and Levelling, Network Crashing – Time- Cost – Resource optimization, Project Monitoring - Methods, Updating and Earned Value Analysis, Introduction to use of Project Management Softwares – MS Project / Primavera, Case study on housing project scheduling for a small project with minimum 25 activities.

Unit –V **(08 hours)**

Project Economics

Introduction to Project Economics - Definition, Principles, Importance in Construction Industry, Difference between Cost, Value, Price, Rent, Simple and Compound Interest, Profit, Annuities, Demand, Demand Schedule, Law of Demand, Demand Curve, Elasticity of Demand, Supply, Supply Schedule, Supply Curve, Elasticity of Supply Equilibrium, Equilibrium Price, Equilibrium Amount, Factors affecting Price Determination, Law of Diminishing Marginal Utility, Law of Substitution, Concept of Cost of Capital, Time Value of Money, Sources of Project Finances –

Concepts of Debt Capital and Equity Capital. Types of Capital – Fixed and Working, Equity Shares and Debenture Capital, FDI in Infrastructure

Unit-VI

(08 hours)

Project appraisal

Types of Appraisals such as Political, Social, Environmental, Techno-Legal, Financial and Economical, Criteria for Project Selection - Benefit - Cost Analysis, NPV, IRR, Pay-Back Period, Break Even Analysis [Fundamental and Application Component], Study of Project Feasibility report and Detailed Project Report (DPR), Role of Project Management Consultants in Pre-tender and Post-tender.

Reference Books

1. Project Management—Khatua—Oxford University
2. Construction Project Management-Planning, Scheduling and Controlling by K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
3. Construction Management and Planning by B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi.
4. The Essentials of Project Management by Dennis Lock, Gower Publishing Ltd. UK.
5. Essentials for Decision Makers by Asok Mukherjee, Scitech Publication, New Delhi.
6. Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra
7. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

Savitribai Phule Pune University
TE Civil (2015 Course) w.e.f. June 2017

301011 Environmental Engineering-I

Teaching scheme	Examination scheme
Lectures: 4 hours/week	In semester exam: 30 marks--1 hour Paper
Practical: 2 hours/week	End semester exam: 70 marks—2.5 hours Paper
	Practical Exam: 50 Marks

Unit-I **(08 hours)**

A) Noise Pollution: Sound measurements – Sound pressure, Intensity, Sound pressure level, Loudness, Equivalent noise level and Cumulative noise level.

B) Air Pollution: Atmospheric stability, Mixing heights, Meteorological parameters.

Air pollution control mechanism. Equipment for particulate contaminants. Principle and working of Settling chamber, Cyclone, Fabric filter, ESP. Gaseous contaminants control by adsorption and absorption technique.

C) Municipal Solid Waste: Concept of Municipal Solid waste management, Sources, Classifications, Treatment (composting & anaerobic digestion) Disposal (sanitary land fill)

Unit -II **(08 hours)**

A) Introduction to water supply scheme: Data collection for water supply scheme, Components and layout. Design period, Factors affecting design period.

B) Quantity: Rate of water consumption for various purposes like domestic, Industrial, Institutional, Commercial, Fire demand and Water system losses, Factors affecting rate of demand, Population forecasting.

C) Quality: Physical, Chemical, Radioactivity and Bacteriological Characteristics, Heavy metals. Standards as per IS: 10500 (2012)

Unit –III **(08 hours)**

A) Water treatment: Principles of water treatment operations and processes, Water treatment flow sheets.

B) Aeration: Principle and Concept, Necessity, Methods, Removal of taste and odour. Design of aeration fountain.

C) Sedimentation: Plain and chemical assisted - principle, efficiency of an ideal settling basin, Settling velocity, Types of sedimentation tanks, Design of sedimentation tank. Introduction & design of tube settlers.

Unit -IV **(08 hours)**

A) Coagulation and flocculation: Principle of coagulation, Common coagulants alum & ferric salts, Introduction to other coagulant aids like bentonite clay, Lime stone, Silicates and Polyelectrolytes, Introduction of natural coagulants, Mean velocity gradient “G” and Power consumption, Design of Flocculation chamber, Design of Clari-flocculator.

B) Filtration: Theory of filtration, Mechanism of filtration, Filter materials, Types: Rapid, Gravity, Pressure filter, Multimedia and dual media filters, Components, Under drainage system, Working and cleaning of filters, Operational troubles, Design of Rapid sand Gravity filters.

Unit -V

(08 hours)

A) Disinfection: Mechanism, Factors affecting disinfection, Types of disinfectants, Types and methods of chlorination, Break point chlorination, Bleaching powder estimation.

B) Water softening methods and Demineralization : lime-soda, Ion-Exchange, R.O. and Electrodialysis

C) Fluoridation and defluoridation.

Unit-VI

(08 hours)

A) Water distribution system: System of water supply- Continuous and intermittent system. Different distribution systems and their components. ESR- Design of ESR capacity. Wastage and leakage of Water- Detection and Prevention.

B) Rainwater harvesting: Introduction, need, methods and components of domestic rainwater harvesting system. Design of roof top rainwater harvesting system.

C) Introduction to Packaged WTP in townships, big commercial plants, necessity (On-site water treatment)

Term Work

Note- Any 8 out of 10 Practicals. (a ,b & c are compulsory.)

a) Practicals.

1. pH and Alkalinity of raw water, soft drinks & tea.
2. Total hardness and components of raw water.
3. Chlorides in water.
4. Chlorine demand and residual chlorine.
5. Sodium or Potassium or Calcium using flame photometer.
6. Turbidity and optimum dose of alum.
7. Fluorides or Iron contents in water.
8. Most Probable Number (MPN)
9. Ambient air quality monitoring for PM10/PM2.5,SO2 & NO_x.
10. Measurement of noise levels at various locations using sound level meter, Calculate cumulative noise level at any one location.

b) Site visit to water treatment plant and Detailed Report.

- c) Assignment 1. Study of Water intake structures.
 2. Complete Design of WTP using appropriate software.

Text / Reference Books

Reference Books:

1. Environmental Engineering: Peavy and Rowe, McGraw Hill Publications.
2. Optimal Design of Water Distribution Networks: P. R. Bhave, Narosa Publishing House.
3. Rain Water Harvesting: Making water every body's business by CSE (Centre for Science and Environment) www.cse.org
4. Harvesting Faith: Linda K. Hubalek. Published by Butterfield books.
5. CPHEEO Manual on Water Supply & Treatment.
6. Standard Methods for the examination of water and waste water, 20th Edition (American Public health Association).

Text Books:

1. Water Supply Engineering: S. K. Garg, Khanna Publishers, New Delhi.
2. Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.
3. Environmental Engineering 1: Water Supply Engineering: B. C. Punmia, Ashok Jain and Arun Jain. Laxmi Publications (P) Ltd.
4. Air Pollution: H. V. N. Rao and M. N. Rao, TMH Publications.
5. Theory and practice of water and waste water treatment--Wiley
6. Water Supply and Treatment Manual: Govt. of India Publication.
7. Waste Water Treatment-Concept Design and Approach---C.L.Karia,R.A.Christian--PHI
8. Environmental Remote Sensing from Regional to Global Scales—Ed.Giles Foody—Wiley
9. Water Supply and Sanitary Engineering: G. S. Birdie and J. S. Birdie, Dhanpat Rai Publishing Company, New Delhi.

Suggested Reading:

- Environmental Engineering by N. N. Barak , MGH
- Environmental Engineering by Venugopal Rao, PHI
- Environmental Engineering by Steel, McGhee , MGH
- Water Supply & Engineering by Pande and Carne , Tata McGraw Hill
- Water Supply Engineering by Harold Eaton Babbit & James Joseph Doland , MGH
- Principles of Water Treatment by Keny J. Howe, MWH.
- Water treatment : principles & Design 3rd edition by John C Crittenden R. Rhodes
- Water quality & Treatment : Handbook on Drinking Water 6th Edition by James K. Edzwald.
- Standard Methods, APHA, AWWA.
- Environmental Engineering Laboratory Manual by B. Kotain & Dr. N. Kumarswamy
- NEERJ Laboratory Manual

Savitribai Phule Pune University
S.E. (Civil Engineering) 2015 Course

Semester I												
Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory (TH)	Tutorials (TUT)	Practical (PR)	In-Sem	End-Sem	TW	PR	OR	Total	TH / TUT	PR/OR / TW
201001	Building Technology and Materials	04	--	02	50	50	50	--	--	150	04	01
207001	Engineering Mathematics III	04	01	--	50	50	50	--	--	150	05	
201006	Surveying	04	--	02	50	50	--	50	--	150	04	01
201002	Strength of Materials	04	--	02	50	50	--	--	50	150	04	01
201003	Geotechnical Engineering	04	--	02	50	50	--	--	50	150	04	01
	Audit Course 1 Awareness to Civil Engineering Practices	--	--	--	--	--	--	--	--	--	Grade	
Total		20	01	08	250	250	100	50	100	750	25	

Note: For audit courses students are given certificate by the institutes based on the assignment submitted by them.

Abbreviations: **TW:** Term Work, **OR:** Oral, **PP:** Passed (Only for non credit courses), **NP:** Not Passed (Only for non credit courses).

Savitribai Phule Pune University
S.E. (Civil Engineering) 2015 Course

Semester II												
Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory (TH)	Tutorials (TUT)	Practical (PR)	In-Sem	End-Sem	TW	PR	OR	Total	TH / TUT	PR/OR / TW
201004	Fluid Mechanics I	04	--	02	50	50	--	--	50	150	04	01
201005	Architectural Planning and Design of Buildings	04	--	02	50	50	--	50	--	150	04	01
201008	Structural Analysis I	03	01	--	50	50	--	--	--	100	04	--
207009	Engineering Geology	04	--	02	50	50	50	--	--	150	04	01
201007	Concrete Technology	04	--	02	50	50	--	--	50	150	04	01
201010	Soft Skill	--	--	02	--	--	50	--	--	50	--	01
	Audit Course 2 Road Safety Management	--	--	--	--	--	--	--	--	--	Grade	
		19	01	10	250	250	100	50	100	750	25	

Note: For audit courses students are given certificate by the institutes based on the assignment submitted by them.

Abbreviations: **TW:** Term Work, **OR:** Oral, **PP:** Passed (Only for non credit courses), **NP:** Not Passed (Only for non credit courses).

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201001: Building Technology and Materials

Credits: 04+01

Teaching Scheme:

Theory : 04 hrs/week

Practical : 02 hrs/week

Examination Scheme:

In-Semester (Online) : 50 Marks

End-Semester : 50 Marks

Term Work : 50 Marks

Prerequisites: Fundamentals of Basic Civil Engineering and Engineering Graphics.

Course Objectives:

- 1) To enumerate different types of structure and their requirement as building components.
- 2) To describe all basic activities of construction from foundation to finishing.
- 3) To study different types of materials used in construction for civil engineering projects.

Course Outcomes:

On completion of the course, learner will be able to:

- 1) Identify types of building and basic requirements of building components.
- 2) Explain types of masonry, formwork, casting procedure and necessity of underpinning and scaffolding.
- 3) Elucidate different types of flooring and roofing materials.
- 4) Describe types of doors, windows, arches and lintel.
- 5) Illuminate means of vertical circulation and protective coatings.
- 6) Explain different materials especially eco-friendly materials and safety measures to be adopted at any construction site.

Course Contents

<p>Unit I: Introduction to Building Construction and Masonry. (08 Hrs)</p> <p>a) Introduction to building construction– definition, types of building as per National Building Code. Building components and their basic requirements i.e substructure and superstructure requirements. Superstructure: Concept and advantages of a framed structure, types: light framed structures, Timber framed, RCC framed structures. Substructure - shallow and deep foundations and their suitability. General procedure in foundation design, Failure of foundation and its causes, Foundation in black cotton soil, Foundations near existing adjacent old structures. Damp Proof Course, plinth filling and soling.</p> <p>b) Masonry– Stone masonry: Principal terms, types of stone masonry. Brick masonry: characteristics of good building bricks, IS specification and tests, classification of bricks: silica, refractory, fire and fly ash bricks. Brick work, types of bonds: English, Flemish, Header, Stretcher, construction procedure, supervision.</p>
<p>Unit II: Block Masonry and Form work (08 Hrs)</p> <p>a) Block Masonry – Cellular lightweight concrete blocks, hollow blocks, concrete blocks, glass blocks, solid blocks, cavity wall construction. Requirement of a good partition wall: metal partitions, asbestos cement partition, wooden partition. Reinforced brick masonry: applications, advantages, materials required and construction procedure. Composite masonry: types, advantages, applications, materials required and construction procedure.</p> <p>b) Form work and casting procedure for reinforced concrete columns, R.C.C. beams and girders, R.C.C. slabs, curing methods, precast and pre-stressed concrete construction and joints in concrete work. Slip form work: component parts- design criteria, underpinning, Scaffolding: purpose, types and suitability.</p>
<p>Unit III: Flooring and Roofing Materials. (08 Hrs)</p> <p>a) Flooring and Flooring Materials – Functional requirement of flooring, types of floor finishes and their suitability, construction details for concrete, tiles and stone flooring. Types of flooring: timber flooring, cement concrete flooring, mosaic flooring, ceramic flooring, terrazzo flooring, tiled flooring, rubber flooring, cork flooring, epoxy asphalt flooring, hollow block and rib floors, Industrial flooring: tremix or Vacuum Dewatered Flooring (VDF).</p> <p>b) Roofing Materials – galvanized iron pre-coated aluminum sheets, fiber sheets, and Mangalore tiles. Roof construction: types and their suitability, method of construction, types of trusses, types of shell structure:dome, translation shells, space and frame structure: pneumatic structures, grain storage structures, prefabricated structures, fixing details of roof covering.</p>

Unit IV: Doors, Windows, Arches and Lintels. (08 Hrs)

a) Doors and Windows – definition of technical terms, installation of doors and window frames and their size specifications, fixtures and fastenings. Types of doors: glazed or sash doors, plastic doors, flush doors, louvered doors, collapsible doors, revolving doors, rolling steel doors, sliding doors, swing doors, folding doors. Types of windows: casement window, double hung window, pivoted window, sliding windows, louvered or venetian window, metal window, sash or glazed window, bay window, corner window, dormer window, gable window, skylight window, circular window, mosquito proof window, curtain wall window. Ventilators: purpose and types.

b) Arches and Lintels – principle of arch action, types of arches, method of arch construction, centering and removal of centering. Lintels: necessity and types, chajja or weather shade necessity and types.

Unit V: Vertical Circulation and Protective Coatings (08 Hrs)

a) Vertical Circulation – Consideration in planning, design considerations, Staircase: types, and details of ramps. Ladders, lifts, and escalator. Types of staircase: straight stairs, open well stairs, quarter turn stairs, half turn stairs, turning stairs, dog-legged stairs, circular stairs, geometrical stairs, bifurcated stairs, and spiral stairs.

b) Protective Coatings – plastering types : lime plaster, cement plaster, gypsum plaster used in spray fire proofing, plaster of Paris and application, pointing: purpose & types, mortar preparation and types, painting and varnishing, types and application, white washing, distemping, oil paints. Wall cladding: materials, method, wall papering and glazing work.

Unit VI: Miscellaneous Materials and Safety in Construction (08 Hrs)

a) Miscellaneous Materials – Properties, types and uses of following materials: lime, polymers, plastic types, mastic, gypsum, clay tiles and glazed wares, Timber: types and properties, advantages and applications of aluminum, stainless steel, fibrous, laminated, particulate, combinations of composite materials: laminated fiber reinforced polymers. Glass: uses, types and properties, application and ingredients, market forms, glass claddings, aluminum composite panel cladding. Ceramic products: ceramic sanitary application, water closet, urinals, washes basins, their common sizes, pipes and fittings. Eco-friendly materials: eco-friendly decorating materials, eco-friendly flooring, thatch, bamboo, linoleum, cork.

b) Safety in Construction – safety on site, storage of materials, construction safety, prevention of accidents, fire proof construction. Repairs and maintenance: addition, and alteration, strutting and shoring.

Books:

Text:

1. Building Construction by B.C. Punmia, Laxmi Publications.
2. Building Materials by S.V.Deodhar, Khanna Publication.
3. Building Construction by Bindra and Arora, Dhanpat Rai Publications.
4. Civil Engineering Materials by Neil Jackson & Ravindra K. Dhir, Palgrave Macmillan.

Reference:

1. Building Materials by S. K. Duggal, New Age International Publishers.
2. Civil Engineering Materials by TTTI Chandigrah, Tata McGraw Hill Publications.
3. Materials of construction by D.N Ghose, Tata McGraw Hill.
4. Building Construction by S.C. Rangwala, Charotdar Publications.
5. National Building Code of India 2005.
6. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.
7. Building Materials Technology by Ruth T. Brantley & L. Reed Brantley, Tata McGraw Hill.
8. Properties of Concrete by A. M. Neville, Pearson Education Limited.
9. Mitchell's Advanced Building Construction: The Structure by J. Stroud Foster

e-Resources:

1. <http://nptel.ac.in/syllabus/105102088/>
2. <http://www.theconstructioncivil.org/types-of-brick-bonds>
3. <http://theconstructor.org/building/types-of-partition-walls/3754>
4. <https://www.osha.gov/Publications/OSHA3252/3252.html>
5. <http://www.engineerwing.com/2012/10/tremix-flooring.html>
6. <http://nptel.ac.in/courses/Webcourse.../Composite%20Materials/.../LNM1.pdf>
7. https://en.wikipedia.org/wiki/Fibre-reinforced_plastic.
8. <https://cdn.intechopen.com/pdfs-wm/41941.pdf>.
9. http://home.iitk.ac.in/~mohite/Composite_introduction.pdf
10. <http://www.vdfflooring.in/faqs.html>.
11. <http://theconstructor.org/building/buildings/eco-friendly-building-materials/720>.
12. <http://nptel.ac.in/courses/105103093/21>.

List of Laboratory Assignments

It shall consist of the following exercises and seminar.

- A) Measurement drawing exercise of an existing residential building (G+1)
Draw a detailed plan, elevation and section using suitable scale on same sheet.
Following sketches pertaining to the above plan (with Standard Dimensions).
- a. Door- Panelled door
 - b. Window
 - c. Stair.
- B) Students should prepare working drawing of Foundation Plan (on tracing paper) for the above Residential Building Plan. It should contain detailed foundation plan with foundation details. (Use suitable scale 1:50 or 1:100).
- C) Draw sketches using computer software of the following:
1. Details of the shallow footings.
 2. Details of arch showing different components
- D) Two site visits and technical report on the visit.
1. Site visit based on existing residential building (G+1) as noted in part A above.
 2. Any on-going Construction Site (visit report should contain: details of the project, stage of construction, sketches of components with cross section & dimensions, materials used and site plan, etc.)
- E) 1. Collection of advertisements of modern construction materials and tools used in construction.
2. Visit to a construction related exhibition.

Term work: Based on above syllabus.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

Awareness to Civil Engineering Practices

Audit Course

(Certificate to be issued by institute based on performance assessment)

Civil Engineering is the oldest engineering profession comprising of a variety of sub-disciplines such as structural engineering, geotechnical, water resources, environmental engineering, construction, transportation etc. Undergraduate programmes are designed with different theoretical approaches on the application of basic sciences to solve different societal problems by engineering knowledge. However, there is a need to make the students aware about how the Civil Engineering industry operates and how theories taught in different courses are applied in practice. The students can learn from the experience gained from different workplaces such as civil engineering consultancies, contracting companies, construction sites etc. The course aims to provide insight of the different practices followed by the industry such as use of different contracts in civil engineering practice, local by-laws, duties and responsibilities of the Engineers, site records and diaries, Health and Safety practices on site, etc.

Course Objectives:

- 1) To provide basic overview of functioning of different civil engineering related industries / firms.
- 2) To provide awareness on application of different drawings, contract documents in civil engineering.
- 3) To provide insight of code of ethics, duties and responsibilities as a Civil Engineer.

Course Outcomes:

- On completion of the course, learner will be able to understand
- 1) Different types of civil engineering industries and their functioning.
 - 2) Applications of different documents, drawings, regulations in Civil Engineering industries.
 - 3) Code of ethics to be practiced by a Civil Engineer and understand duties and responsibilities as a Civil Engineer
 - 4) Different safety practices on the site.

Course Contents

1. Awareness lectures by professionals.
2. Visit to construction site/ architectural firms/ structural engineering firms etc.
3. Discuss on issues such as sustainability, eco-friendly techniques, use of locally available materials etc. directly related to techno economic development of society.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201005: Architectural Planning and Design of Buildings

Credits: 04+01

Teaching Scheme:

Theory : 04 hrs/week

Practical : 02 hrs/week

Examination Scheme:

In-Semester (Online) : 50 Marks

End-Semester : 50 Marks

Practical : 50 Marks

Prerequisites : Basic Civil Engineering, Building Technology and Materials, National Building Code-2005, Developing Control Rules and Green building concepts.

Course Objectives:

- 1) To understand necessity of Town planning, principles of planning, principles of architecture and byelaws.
- 2) To study the planning for building services such as noise and acoustics, ventilation, lighting, plumbing work and safety practices.
- 3) To develop the plan, elevation and section of load bearing and framed structures.

Course Outcomes:

On completion of the course, learner will be able to:

- 1) Make use of principles of planning and principles of architectural Planning.
- 2) Analyze the available primary or secondary data and plan different types of structures considering futuristic need of an area.
- 3) Improve the status of existing structures by proposing appropriate green measures.
- 4) Plan effectively various types of buildings according to their utility with reference to different codes.
- 5) Understand and resolve contemporary issues at multi-dimensional functional levels.

Course Contents

Unit I: Town planning and legal aspects.

(08 Hrs)

a) Town Planning : Necessity and evolution of town planning in India. Development plan and its importance, Objectives and Contents of DP, Land use zoning, Introduction to different zones of land in town planning, Requirements of various zones, Height zoning and Density zoning.

b) Legal Aspects : Role of Plan sanctioning authority, 7/12 abstract, meaning of different terms of 7/12 abstract, Form 6 and its types, Concept of TDR, List of documents to be submitted to local authority, Procedure for seeking Commencement and Occupancy Certificate, Various NOCs required.

Unit II: Architectural Planning , Building bye laws and introduction to Green Buildings (08 Hrs)

- a) Principles of Architectural design relation between form and function, utility, aesthetics. Necessity of bye-laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), concept of V.P.R. Marginal distances, building line : control line, height regulations, room sizes, Area calculations (built-up area, carpet area etc.), Rules for ventilation, lighting, Vertical circulation, Sanitation and Parking of vehicles.
- b) Green buildings: salient features, benefits, planning concepts (site selection, orientation, sun path and wind diagram etc.), Rating systems (LEED, GRIHA etc.)

Unit III: Architectural Drawing and Safety Aspects (08 Hrs)

- a) Introduction to Architectural drawing :** i) Line plan, ii) Developed Plan, iii) Elevation, iv) Section, Selection of scales for various drawings, dimensioning, abbreviations and conventions as per IS 962, Elements of perspective drawings, parallel and angular perspective of small building elements.
- b) Safety Aspects:** Fire load, grading of occupancies by fire loads, Evacuation Time, fire escape elements, Need for earthquake resistant structures, planning considerations, disaster management.

Unit IV: Building Services (08 Hrs)

- a) Noise and Acoustics** – Sound insulation, Acoustical defects, Reverberation time, Sabine's formula, sound absorbents, planning for good acoustics.
- b) Ventilation** – Necessity of Ventilation, Natural ventilation: stack effect and wind effect, Thermal Insulation, Mechanical ventilation and its types, air conditioning systems.
- c) Lighting** – Principles of day lighting, design of windows, artificial illumination, SC, ERC, IRC, Daylight factor, Solar energy systems for lighting (BIPV).
- d) Plumbing** – Water storage tanks at ground level and on terrace (capacity), Plumbing systems, various types of traps, Fixtures and Fittings, Rain Water Harvesting etc.
- e) Other services** – Telecommunication, Electrical, Smart services and Waste management etc.

Unit V: Planning of Residential Buildings (08 Hrs)

- a) Functional requirements of Bungalows, Twin bungalows, Row houses, Ownership flats, and Apartments.
- b) Developed Plan, Elevation and Sectional Elevation of above mentioned categories.

Unit VI: Planning of Public Buildings (08 Hrs)
a) Functional requirements and planning of industrial buildings, commercial buildings, School, Colleges , Hostel, Auditorium, Restaurant/ Hotel building, Primary Health Center/ Hospital, Shopping complex, Sports complex, Vegetable market, Post office, Bank buildings etc .
b) Dimensioned line plans of above public buildings.
Books:
Text:
1. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill. (5th edition.)
2. Building science and planning by Dr. S. V. Deodhar, Khanna Publishers.
3. Building Services Engineering by David V. Chadderton, sixth edition, London & New York.
4. Drawing for Civil Engineering by Jan A. Van Der Westhuizen
Reference:
1. National Building Code (latest).
2. Building Design and construction by Frederick Merrit, Tata McGraw Hill.
3. Times Saver standards of Architectural Design Data by Callender, Tata McGraw Hill.
4. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.
5. Development plan and DCP Rules of urban local body, New Delhi, Volume 12.
6. Model building bye laws by MoUD, GoI.
e-Resources :
1. http://www.grihaindia.org/
2. http://new.usgbc.org/
3. http://www.hcd.ca.gov/hpd/green_build.pdf
4. http://ncict.net/Examples/Examples1.aspx
5. http://www.igbc.in/site/igbc

List of Laboratory Assignments

Students shall prepare working drawings of any type of building from the list given in Unit V or Unit VI (**Individual project to be planned and manually drafted to suitable scale**):

1. Layout/ Site plan indicating water supply and drainage line (with area statement).
2. Floor Plan/ Typical floor plan (with construction notes, schedule of openings).
3. Elevation and Sectional Elevation (preferably to be drawn on same sheet).
4. Developing measurement drawing exercise done in BTM course using CAD and Printout of the same.
5. Perspective drawing of a small building element.
6. Report file: It shall consist of data given for the project, Planning considerations and line plans, Design calculations.

Practical examination will be based on above syllabus and exercises mentioned in the list.

It will consist of :

- i) Planning exercise on development of line plan or drawing the line plan using suitable Software or manual drafting.
- ii) Exercise on D.C. Rules / numerical thereon or perspective drawing.

Assessment criteria: Line work, Planning/ designing abilities, Presentation and Understanding based on oral examination of relevant exercises.

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

201010: Soft Skill

Credits: 01

Teaching Scheme:

Practical: 02 hrs/week

Examination Scheme:

Term Work : 50 Marks

Prerequisites: Basic communication and writing skills in English.

Course Objectives:

- 1) To help the students in building interpersonal skills.
- 2) To develop skill to communicate clearly.
- 3) To enhance team building and time management skills.
- 4) To learn active listening and responding skills.

Course Outcomes:

On completion of the course, learner will be able to:

- 1) Make use of techniques for self-awareness and self-development.
- 2) Apply the conceptual understanding of communication into everyday practice.
- 3) Understand the importance of teamwork and group discussions skills.
- 4) Develop time management and stress management.
- 5) Apply business etiquette skills effectively an engineer requires.

Course Contents

UNIT I: Self Awareness & self Development

(04 hrs)

a) Self Awareness: Self Assessment, Self Appraisal, SWOT, Goal setting: Personal & career: Self Assessment, Self-Awareness, Perceptions and Attitudes, Positive Attitude, Values and Belief Systems, Self-Esteem, Self appraisal, Personal Goal setting.

b) Self Development: Career Planning, Personal success factors, Handling failure, Depression and Habit, relating SWOT analysis & goal setting, prioritization.

UNIT II: Communication Skill	(06 hrs)
<p>a) Communication: Importance, types, barriers of communication, effective communication.</p> <p>b) Speaking Skills: Public Speaking, Presentation skills, Group discussion: Importance of speaking effectively, speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self expression, body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, positive image projection techniques.</p> <p>c) Listening Skills: Law of nature: you have 2 ears and 1 tongue so listen twice and speak once is the best policy, Empathic listening, and Avoid selective listening.</p> <p>d) Group Discussion: characteristics, subject knowledge, oral and leadership skills, team management, strategies and individual contribution and consistency.</p> <p>e) Presentation skills: planning, preparation, organization, delivery.</p>	
<p>f) Written Skills: Formal & Informal letter writing, Report writing, Resume writing: Sentence structure, sentence coherence, emphasis. Paragraph writing. Letter writing skills: form and structure, style and tone. Inquiry letters, Instruction letters, complaint letters, Routine business letters, Sales Letters etc.</p>	
UNIT III: Corporate / Business Etiquettes	(02 hrs)
<p>a) Corporate / Business Etiquettes: Corporate grooming & dressing, Email & telephone etiquettes, etiquettes in social & office setting: Understand the importance of professional behaviour at the work place, Understand and Implement etiquettes in workplace, presenting oneself with finesse and making others comfortable in a business setting.</p> <p>b) Importance of first impression, Grooming, Wardrobe, Body language, Meeting etiquettes (targeted at young professionals who are just entering business environment) , Introduction to Ethics in engineering and ethical reasoning, rights and responsibilities.</p>	
UNIT IV: Interpersonal relationship	(04 hrs)
<p>a) Team work: Team effectiveness, Group discussion, Decision making : Team Communication. Team, Conflict Resolution, Team Goal Setting, Team Motivation Understanding Team Development, Team Problem Solving, Building the team dynamics. Multicultural team activity.</p> <p>b) Group Discussion (GD): Preparation for a GD, Introduction and definitions of a GD, Purpose of a GD, Types of GD, Strategies in a GD , Conflict management, Do's and Don'ts in GD.</p>	

UNIT V: Leadership skills	(02 hrs)
a) Leadership: Leaders' role, responsibilities and skill required - Understanding good Leadership behaviors, Learning the difference between Leadership and Management, Gaining insight into your Patterns, Beliefs and Rules.	
b) Leadership Qualities: Defining Qualities and Strengths of leadership, Determining how well you perceive what's going on around you, interpersonal Skills and Communication Skills, Learning about Commitment and How to Move Things Forward, Making Key Decisions, Handling Your and Other People's Stress, Empowering, Motivating and Inspiring Others, Leading by example, effective feedback.	
UNIT VI: Other skills	(02 hrs)
a) Time management: The Time management matrix, apply the Pareto Principle (80/20 Rule) to time management issues, to prioritise using decision matrices, to beat the most common time wasters, how to plan ahead, how to handle interruptions , to maximize your personal effectiveness, how to say “no” to time wasters, develop your own individualized plan of action.	
b) Stress management: understanding the stress & its impact, techniques of handling stress	
c) Skills: Problem solving skill, Confidence building Problem solving skill, Confidence building.	
Books:	
Text:	
1. Communication Skills by Sanjay Kumar and Pushpa Lata, Oxford University Press.	
2. Developing Communication Skill by Krishna Mohan, Meera Banerji, McMillan India Ltd.	
3. English for Business Communication by Simon Sweeney, Cambridge University Press.	

Savitribai Phule Pune University, Pune
S.E. (Civil Engineering) 2015 Course

Road Safety Management

Audit Course

(Certificate to be issued by institute based on performance assessment)

Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory regulation has been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the World statistics; but the comparable proportion for accidents is substantially large.

The need for stricter enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as also in India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the ibid stake holders who are expected to follow the rules and policies of the government in order to facilitate safety of individual and safe mobility of others.

Course Objectives:

- 1) To provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country.
- 2) To explain the engineering & legislative measures for road safety.
- 3) To discuss measures for improving road safety education levels among the public.

Course Outcomes:

On completion of the course, learners will:

- 1) Show changes in awareness levels, knowledge and understanding.
- 2) Demonstrate a change in attitudes / behavior e.g. against drink-drive.
- 3) Utilize remedial education for those who make mistakes and for low level offences where this is more effective than financial penalties and penalty points.
- 4) Improve road safety together leading to casualty reduction

Course Contents

1. Existing Road Transport Scenario
2. Accident Causes & Remedies
3. Road Accident Investigation & Investigation Methods
4. Vehicle Technology – CMVR & Road Safety
5. Regulatory / Legislative Provisions for Improving Road Safety
6. Behavioral Training for Drivers for Improving Road Safety
7. Road Engineering Measures for Improving Road Safety

Guidelines for Conduction (Any one or more of following but not limited to)

1. Guest Lectures.
2. Visits and reports.
3. Assist authorities like RTO for audits (e.g. Particular road safety audit as critical on-site assessment of the shortcomings in the various elements of the road).
4. Mini Project

Guidelines for Assessment (Any one of following but not limited to)

1. Written Test
2. Practical Test
3. Presentation
4. Report

Savitribai Phule Pune University, Pune 2012 Course

B. E. (Mechanical) Semester – I

(w. e. f. Academic year 2015 - 16)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme(Marks)					
		Lect.	Tut	Practical	In-Sem	End-Sem	TW	PR ⁺	OR ⁺	Total
402041	Refrigeration and Air Conditioning	3	--	2	30	70	25	--	50	175
402042	CAD/ CAM Automation	3	--	2	30	70	--	50	--	150
402043	Dynamics of Machinery	4	--	2	30	70	25	--	50	175
402044	Elective – I	3	--	--	30	70	--	--	--	100
402045	Elective –II	3	--	--	30	70	--	--	--	100
402046	Project –I	--	2	--	--	--	50*	--	--	50
Total of Semester – I		16	2	6	150	350	100	50	100	750

B. E. (Mechanical) Semester – II

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme(Marks)					
		Lect.	Tut	Practical	In-Sem	End-Sem	TW	PR ⁺	OR ⁺	Total
402047	Power Plant Engineering	4	--	2	30	70	25	--	50	175
402048	Mechanical System Design	4	--	2	30	70	--	--	50	150
402049	Elective-III	4	--	--	30	70	--	--	--	100
402050	Elective- IV	4	--	2	30	70	25	--	--	125
402051	Project – II	--	6	--	--	--	150	--	50	200
Total of Semester – II		16	6	6	120	280	200	--	150	750

+ For all Oral/Practical heads: Examination will be based on term work and Theory Subject

* Assessment should be carried out by panel of examiners from same Institute

Elective-I		Elective-II	
Code	Subject	Code	Subject
402044 A	Energy Audit Management	402045 A	Gas Turbine Propulsion
402044 B	Tribology	402045 B	Product Design and Development
402044 C	Reliability Engineering	402045 C	Operation Research
402044 D	Machine Tool Design	402045 D	Advanced Manufacturing Processes
Elective-III		Elective-IV	
Code	Subject	Code	Subject
402049 A	Refrigeration and Air Conditioning Equipment Design	402050 A	Computational Fluid Dynamics
402049 B	Robotics	402050 B	Finite Element Analysis
402049 C	Industrial Engineering	402050 C	Design of Pumps, Blowers and Compressors
402049 D	Open Elective **		

** : Open Elective – Board of studies (BoS) - Mechanical will declare the list of subjects which can be taken under open electives OR any other Electives that are being taught in the respective current semester, to the same level, as Elective – III under engineering faculty OR individual college and Industry can define new elective with proper syllabus using defined framework of Elective III and GET IT APPROVED FROM BOARD OF STUDIES AND OTHER NECESSARY STATUTORY SYSTEMS IN THE SAVITRIBAI PHULE PUNE UNIVERSITY BEFORE DEAD LINE GIVEN BY SPPU (SAY 30th NOVEMBER). Without approval from University statutory system, no one can introduce the open elective in curriculum.

(402041) Refrigeration and Air Conditioning

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402041	Refrigeration and Air Conditioning	3	---	2	30 (1 hr)	70 (2 ½ hrs)	25	---	50	175

Prerequisite: Basic Thermodynamics- Laws of thermodynamics, Ideal gas processes, Thermodynamic cycles, Properties of pure substance, Mollier Charts, Fluid properties, Fluid dynamics, Modes of heat transfer, Governing Equations in Heat Transfer, Extended Surfaces, Condensation and Boiling, Heat Exchangers.

Course Objectives

- Learning the fundamental principles and different methods of refrigeration and air conditioning.
- Study of various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.
- Comparative study of different refrigerants with respect to properties, applications and environmental issues.
- Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
- Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems

Course Outcomes: At the end of this course the students should be able to

- Illustrate the fundamental principles and applications of refrigeration and air conditioning system
- Obtain cooling capacity and coefficient of performance by conducting test on vapor compression refrigeration systems
- Present the properties, applications and environmental issues of different refrigerants
- Calculate cooling load for air conditioning systems used for various applications
- Operate and analyze the refrigeration and air conditioning systems.
-

Unit 1: Fundamentals and Applications of Refrigeration and Air Conditioning 8 hrs

Fundamentals

Reverse Carnot cycle, block diagram of refrigerator & heat pump (numerical), modified reverse Carnot cycle (Bell Coleman cycle)

Applications

Domestic Refrigerator, Domestic Air Conditioners, Automotive Air Conditioners, Evaporative coolers, water coolers, Commercial Refrigeration- Dairy, Cold storage, Ice plant, Commercial Air Conditioning- Multiplex, Hospitals.

Unit 2: Refrigerants and Vapour Compression Cycle 8 hrs

Refrigerants

Classification of refrigerants, Desirable properties of refrigerants, environmental issues, Ozone depletion and global warming, ODP, GWP & LCCP, selection of environment friendly refrigerants, secondary refrigerants, anti-freeze solutions, Zeotropes and Azeotropes, refrigerant: recovery reclaims, recycle and recharge.

Vapour Compression Cycle

Working of simple vapour compression system, representation of vapour compression cycle (VCC) on T-s and P-h diagram, COP, EER, SEER, IPLV, NPLV, effect of operating parameters on performance of

Savitribai Phule Pune University, Pune 2012 Course

VCC, actual VCC, methods of improving COP using flash chamber, sub-cooling, liquid vapour heat exchanger, comparison of VCC with Reverse Carnot cycle,.

Unit 3: Refrigeration Systems

8 hrs

Vapour compression systems

Single stage, two stage and cascade VCC systems using single and multi evaporators

Vapour absorption systems

Introduction, Working of simple vapour absorption system (VAS), desirable properties of binary mixture (aqua-ammonia), performance evaluation of simple VAS (simple numerical treatment), actual VAS, Li-Br absorption system, three fluid system (Electrolux refrigeration), applications of VAS, comparison between VCC and VAC.

Unit 4: Psychrometric and Air conditioning

8 hrs

Introduction to air conditioning, psychrometric, psychrometric properties and terms, psychrometric relations, Psychrometric processes and its representation on psychrometric chart, BPF of coil, ADP, adiabatic mixing of two air streams, SHF, RSHF, GSHF, ESHF.

Thermodynamics of human body, comfort and comfort chart, factors affecting human comfort, concept of infiltration and ventilation, indoor air quality requirements, factors contributing to cooling load.

Unit 5 Air Conditioning Systems

8 hrs

Working of summer, winter and all year round AC systems, all air system, all water system, air water system, variable refrigerant flow and variable air volume systems, unitary and central air conditioning.

Components of refrigeration and air conditioning systems

Working of reciprocating, screw and scroll compressors, working of air cooled, water cooled and evaporative condensers, Working of DX, Flooded, Forced feed evaporators, Expansion devices – Capillary tube, TXV, EXV, operating and safety controls.

Unit 6: Air Distribution Systems

8 hrs

Air handling unit, Classification of ducts, duct material, pressure in ducts, flow through duct, pressure losses in duct (friction losses, dynamic losses), air flow through simple duct system, equivalent diameter, methods of duct system design: equal friction, velocity reduction, static regain method (numerical on duct system design)

Fan coil unit, types of fans used air conditioning applications, fan laws, filters, supply and return grills, sensors (humidity, temperature, smoke).

Term work:

The term work shall consist of minimum eight experiments out of the following:

- 1) Test on Domestic Refrigerator for evaluation of EER
- 2) Test on vapour compression test rig
- 3) Test on air conditioning test rig
- 4) Test on ice plant test rig
- 5) Visit to Vapour absorption refrigeration plant
- 6) Estimation of cooling load of simple air conditioning system (case study)
- 7) Case study on cold storage
- 8) Visit to any air conditioning plant
- 9) Thermal analysis of refrigeration cycle using suitable software
- 10) Installation and servicing of split air conditioner

Text Books

1. Arora C. P., Refrigeration and Air Conditioning, Tata McGraw-Hill
2. Manohar Prasad, Refrigeration and Air Conditioning, Willey Eastern Ltd, 1983
3. McQuiston, “ Heating Ventilating and air Conditioning: Analysis and Design” 6th Edition, Wiley India
4. Arora and Domkundwar, Refrigeration & Air Conditioning, Dhanpatrai & Company, New Delhi

Savitribai Phule Pune University, Pune 2012 Course

5. Khurmi R.S. and Gupta J.K., Refrigeration and Air conditioning, Eurasia Publishing House Pvt. Ltd, New Delhi, 1994.
6. Ballaney P.L., Refrigeration and Air conditioning, Khanna Publishers, New Delhi, 1992

Reference books

1. Dossat Ray J, Principles of refrigeration, S.I. version, Willey Eastern Ltd, 2000
2. Stockers W.F and Jones J.W., Refrigeration and Air conditioning, McGraw Hill International editions 1982.
3. Threlkeld J.L, Thermal Environmental Engineering, Prentice Hall Inc., New Delhi
4. Aanatnarayan, Basics of refrigeration and Air Conditioning, Tata McGraw Hill Publications
5. Roger Legg, Air Conditioning System Design, Commissioning and Maintenance
6. ASHRAE & ISHRAE handbook

SEMESTER II

(402047) Power Plant Engineering

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut.	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
402047	Power Plant Engineering	4	---	2	30 (1 hr)	70 (2 ½ hrs)	2	--	50	175

Prerequisites

Thermodynamics, Basic Mechanical Engineering, Turbo Machine, and Internal Combustion Engine

Course Objectives

- To develop an ability to apply knowledge of mathematics, science, and engineering.
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To develop an ability to identify, formulate, and solve engineering problems.
- To develop an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes

- Ability to have adequacy with Design, erection and development of energy conversion plants.
- Optimization of Energy Conversion plant with respect to the available resources.
- Scope of alternative erection of optimized, suitable plant at the location depending upon geographical conditions.

Unit 1: Introduction

8 hrs

A) Power Generation: Global Scenario, Present status of power generation in India, in Maharashtra, Role of private and governmental organizations, Load shedding, Carbon credits, Pitfalls in power reforms, concept of cascade efficiency.

B) Economics of Power Generation: Introduction, Cost of electric energy, Fixed and operating cost, (with numerical treatment), Selection and Type of generation, Selection of generation equipment, Performance and operation characteristics of power plants and Tariff methods.

Unit 2: Thermal Power Plant

10 hrs

A) Introduction: General layout of modern power plant with different circuits, working of thermal power plant, coal classification, coal, ash and dust handling, selection of coal for Thermal Power Plant, FBC boilers, high pressure boiler, Rankine cycle with reheat and regeneration, cogeneration power plant (with numerical)

B) Steam Condenser: Necessity of steam condenser, Classification, Cooling water requirements, Condenser efficiency, Vacuum efficiency, Cooling towers, air Leakage, Effects of Air Leakage on condenser performance, (Numerical Treatment)

Unit 3: Hydroelectric and Nuclear power plant

8 hrs

A) Hydroelectric Power Plant: Introduction, Site Selection, Advantages and Disadvantages of HEPP, Hydrograph, Flow duration curve, Mass Curve, Classification of HEPP with layout.

Savitribai Phule Pune University, Pune 2012 Course

B) Nuclear Power Plants: Elements of NPP, Nuclear reactor & its types, fuels moderators, coolants, control rod, classification of NPP, N-waste disposal

Unit 4: Diesel & Gas Turbine Power plant **8 hrs**

A) Diesel Engine Power Plants: Plant Layout, Diesel Engine Power Plant Performance Analysis, application, selection of engine size, advantages & disadvantages of diesel power plant.

B) Gas Turbine Power Plant : Introduction, fuels, materials selection for GTPP, Brayton Cycle analysis, Thermal Efficiency, Work ratio, maximum & optimum pressure ratio, Actual cycle effect of operating variables on thermal efficiency, inter-cooling reheating, & regeneration cycle, Open, Closed & Semi Closed cycles Gas Turbine Plant , combined cycle plant (Numerical Treatment).

Unit 5: Non-Conventional Power Plants **8 hrs**

Wind Power plant : Introduction, wind availability measurement, types of wind machines, site selection, and wind power generation.

Solar Power Plant : Introduction, components ,Types of Collectors & Solar Ponds, Low & High Temperature Solar Power Plant. Photovoltaic Power System, Heliostat

Tidal, OTEC, geothermal, magneto hydrodynamics, fuel cell, hybrid power plants, Challenges in commercialization of Non-Conventional Power Plants.

Unit 6: Instrumentation and Environmental Impact **8 hrs**

A) Power Plant Instrumentation

Layout of electrical equipment, generator, exciter, short circuits & limiting methods, switch gear, circuit breaker, power transformers, methods of earthing, protective devices & Control system used in power plants, Control Room.

B) Environmental impact due to power plants.

Environmental aspects, introduction, constituents of atmosphere, different pollutants due to thermal power plants and their effects of human health, Environmental control of different pollutant such as particulate matter, Oxides of sulphur, nitrogen, global warming & green house effect, thermal pollution of water & its control. Noise pollution by power plants.

Term Work: Any Eight experiments of the following-

- 1) Visit to thermal Power plant /Co-generation Power plant or explain working of power plant by using suitable software.
- 2) Visit to HEPP/GTPP/Non-Conventional Power Plants.
- 3) Study of FBC system.
- 4) Study of High Pressure boilers.
- 5) Trial on steam power plant.
- 6) Trial on Diesel Power Plant.
- 7) Study of power plant instruments.
- 8) Study of Nuclear Power Plants.
- 9) Study of Environmental Impact of Power Plants.

Reference Books

1. E.I.Wakil, "Power Plant Engineering", McGraw Hill Publications New Delhi
2. P.K.Nag, "Power Plant Engineering", McGraw Hill Publications New Delhi.
3. K K Ramalingam , " Power Plant Engineering, SCITECH Publications Pvt Ltd.
4. Domkundwar & Arora, "Power Plant Engineering", Dhanpat Rai & Sons, New Delhi.
5. R.K.Rajput, "Power Plant Engineering", Laxmi Publications New Delhi.
6. R.Yadav , "Steam and Gas Turbines" ,Central Publishing House, Allahabad.
7. D.K.Chavan & G.K.Phatak, "Power Plant Engineering" , Standard Book House, New Delhi.
8. G.D.Rai, " Non-Conventional Energy Sources" Khanna Publishers,Delhi
9. S.P.Sukhatme, "Solar Energy" Tata McGraw-Hill Publications, New Delhi

Savitribai Phule University of Pune
Third Year Computer Engineering (2015 Course)
(with effect from 2017-18)

Semester I

Course Code	Course	Teaching Scheme Hours / Week			Examination Scheme and Marks						Credit		
		Theory	Tutorial	Practical	In-Sem	End-Sem	TW	PR	OR	Total	TH/ TUT	PR	
310241	Theory of Computation	03	--	--	30	70	--	--	--	100	03	--	
310242	Database Management Systems (DBMS)	03	--	--	30	70	--	--	--	100	03	--	
310243	Software Engineering & Project Management	03	--	--	30	70	--	--	--	100	03	--	
310244	Information Systems & Engineering Economics	03	--	--	30	70	--	--	--	100	03	--	
310245	Computer Networks (CN)	04	--	--	30	70	--	--	--	100	04	--	
310246	Skills Development Lab	--	02	04	--	--	50	--	50	100	02	02	
310247	DBMS Lab	--	--	04	--	--	25	50	--	75	--	02	
310248	CN Lab	--	--	02	--	--	25	50	--	75	--	01	
Total Credit											18	05	
Total		16	02	10	150	350	100	100	50	750	23		
310249	Audit Course 3											Grade	

310249-Audit Course 3 (AC3) Options:

AC3-I: Cyber Security

AC3-II: Professional Ethics and Etiquettes

AC3-III: Emotional Intelligence

AC3-IV: MOOC- Learn New Skills

AC3-V: Foreign Language (Japanese- Module 3)

Abbreviations:

TW: Term Work **TH:** Theory **OR:** Oral **TUT:** Tutorial **PR:** Practical **Sem:** Semester

Savitribai Phule University of Pune Third Year Computer Engineering (2015 Course) (with effect from 2017-18)													
<u>Semester II</u>													
Course Code	Course	Teaching Scheme Hours / Week			Examination Scheme and Marks						Credit		
		Theory	Tutorial	Practical	In-Sem	End-Sem	TW	PR	OR	Total	TH/ TUT	PR	
310250	<u>Design & Analysis of Algorithms</u>	04	--	--	30	70	--	--	--	100	04		
310251	<u>Systems Programming & Operating System (SP & OS)</u>	04	--	--	30	70	--	--	--	100	04	--	
310252	<u>Embedded Systems & Internet of Things (ES & IoT)</u>	04	--	--	30	70	--	--	--	100	04	--	
310253	<u>Software Modeling and Design</u>	03	--	--	30	70	--	--	--	100	03	--	
310254	<u>Web Technology</u>	03	--	--	30	70	--	--	--	100	03	--	
310255	<u>Seminar & Technical Communication</u>	--	01	--	--	--	50	--	--	50	01	--	
310256	<u>Web Technology Lab</u>	--	--	02	--	--	25	50	--	75	--	01	
310257	<u>SP & OS Lab</u>	--	--	04	--	--	25	50	--	75	--	02	
310258	<u>ES & IoT Lab</u>	--	--	02	--	--	50	--	--	50	--	01	
Total Credit											19	04	
Total		18	01	08	150	350	150	100	--	750	23		
310259	<u>Audit Course 4</u>											Grade	

310259-Audit Course 4(AC4) Options:

AC4-I: Digital and Social Media Marketing

AC4-II: Green Computing

AC4-III: Sustainable Energy Systems

AC4-IV: Leadership and Personality Development

AC4-V: Foreign Language (Japanese- Module 4)

Abbreviations:

TW: Term Work **TH:** Theory **OR:** Oral **TUT:** Tutorial **PR:** Practical **Sem:** Semester

Savitribai Phule Pune University
T.E. Mechanical Engineering 2015 – Course
T. E. (Mechanical) (2015 Course) Semester – I

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits	
		Lecture	Tut	Pract	In-Sem	ESE	TW	PR	OR		Th	TW / PR / OR
302041	Design of Machine Elements-I	4	-	2	30@	70@	50	-		150	4	1
302042	Heat Transfer*	4	-	2	30	70		50	-	150	4	1
302043	Theory of Machines-II [§]	3	1		30	70	25	-	25	150	3	1
302044	Turbo Machines	3	-	2	30	70	-	-	25	125	3	1
302045	Metrology and Quality Control [§]	3	-	2	30	70	-	-	25	125	3	1
302046	Skill Development	-	-	2	-	-	25	25	-	50	-	1
Total		17	1	10	150	350	100	75	75	750	17	6
23												

T. E. (Mechanical) (2015 Course) Semester – II

Code	Subject	Teaching Scheme Hrs / week			Examination Scheme					Total Marks	Credits	
		Lecture	Tut	Pract	In-Sem	ESE	TW	PR	OR		Th	TW / PR / OR
302047	Numerical Methods and Optimization*	4	-	2	30	70	-	50	-	150	4	1
302048	Design of Machine Elements-II	4	-	2	30@	70@	25	-	25	150	4	1
302049	Refrigeration and Air Conditioning	3	-	2	30	70	-	-	25	125	3	1
302050	Mechatronics [%]	3	1		30	70	-	-	25	125	3	1
302051	Manufacturing - Process-II [§]	3	-	-	30	70	-	-	-	100	3	-
302052	Machine Shop-II [§]	-	-	2	-	-	50	-	-	50	-	1
302053	Seminar [§]	-	-	2	-	-	25	-	25#	50	-	1
302054	Audit Course*	--	--	--	--	--	-	-	-	-	-	-
Total		17	1	10	150	350	100	50	100	750	17	6
23												

Though it is under Oral head Internal Panel to be appointed by Principal and HOD.

Examination schedule will not be prepared at University level.

* Marked subjects are common with TE (Auto. Engg.) and TE Mech. Sandwich

§ Marked subjects are common with TE (Auto. Engg.) only

% Marked subjects are common with TE Mech. Sandwich only

@ Examination time for Insem examination 1 Hr 30 Min. and Endsem examination 3Hrs.

Savitribai Phule Pune University, Pune
Third Year of Mechanical, Mechanical Sandwich & Automobile
(2015 Course)

Course Code: 302042

Course Name : HEAT TRANSFER

Teaching Scheme:	Credits	Examination Scheme:
TH: - 4 Hrs/ Week	TH:--04	TH In-Sem: -- 30
		End-Sem: -- 70
PR: - 2 Hrs/ Week	PR:--01	PR: -- 50

Course Objectives:

1. Identify the important modes of heat transfer and their applications.
2. Formulate and apply the general three dimensional heat conduction equations.
3. Analyze the thermal systems with internal heat generation and lumped heat capacitance.
4. Understand the mechanism of convective heat transfer
5. Determine the radiative heat transfer between surfaces.
6. Describe the various two phase heat transfer phenomenon. Execute the effectiveness and rating of heat exchangers.

Course Outcomes:

CO 1: Analyze the various modes of heat transfer and implement the basic heat conduction equations for steady one dimensional thermal system.

CO 2: Implement the general heat conduction equation to thermal systems with and without internal heat generation and transient heat conduction.

CO 3: Analyze the heat transfer rate in natural and forced convection and evaluate through experimentation investigation.

CO 4: Interpret heat transfer by radiation between objects with simple geometries.

CO 5: Analyze the heat transfer equipment and investigate the performance.

Course Contents

UNIT 1:	(10 hrs)
<p>Introduction and Basic Concepts: Application areas of heat transfer, Modes and Laws of heat transfer, Three dimensional heat conduction equation in Cartesian coordinates and its simplified equations, thermal conductivity, Thermal diffusivity, Thermal contact Resistance</p>	
<p>Boundary and initial conditions: Temperature boundary condition, heat flux boundary condition, convection boundary condition, radiation boundary condition.</p>	
<p>One dimensional steady state heat conduction without heat generation: Heat conduction in plane wall, composite slab, composite cylinder, composite sphere, electrical analogy, concept of thermal resistance and conductance, three dimensional heat conduction equations in cylindrical and spherical coordinates (no derivation) and its reduction to one dimensional form, critical radius of insulation for cylinders and spheres, economic thickness of insulation.</p>	
UNIT 2:	(08 hrs)
<p>One dimensional steady state heat conduction with heat generation: Heat conduction with uniform heat generation in plane wall, cylinder & sphere with different boundary conditions.</p>	
<p>Heat transfer through extended surface: Types of fins and its applications, Governing Equation for constant cross sectional area fins, solution for infinitely long & adequately long (with insulated end) fins, efficiency & effectiveness of fins.</p>	
UNIT 3:	(06 hrs)
<p>Thermal Insulation – Types and selection, Economic and cost considerations, Payback period</p>	
<p>Transient heat conduction: Validity and criteria of lumped system analysis, Biot and Fourier number, Time constant and response of thermocouple, Transient heat analysis using charts.</p>	
UNIT4:	(08hrs)
<p>Convection</p>	
<p>Fundamentals of convection: Mechanism of natural and forced convection, local and average heat transfer coefficient, concept of velocity & thermal boundary layers.</p>	
<p>Forced convection: Dimensionless numbers and their physical significance, empirical correlations for external & internal flow for both laminar and turbulent flows.</p>	
<p>Natural convection: Introduction, dimensionless numbers and their physical significance, empirical correlations for natural convection.</p>	
UNIT 5: Radiation	(08 hrs)
<p>Fundamental concepts, Spectral and total emissive power, real and grey surfaces, Stefan Boltzmann law, Radiation laws – Planks, Wiens, Kirchoff's and Lambert's cosine law with simple applications, Irradiation and radiosity, Electrical analogy in radiation, Radiation shape factor, radiation heat exchange between two black and diffuse gray surfaces, radiation shield.</p>	

UNIT 6: Heat Transfer Equipments**(08 hrs)**

Condensation and Boiling: Boiling heat transfer, types of boiling, pool boiling curve and forced boiling phenomenon, condensation heat transfer, film wise and drop wise condensation (simple numerical treatment).

Heat exchangers: Classification and applications, heat exchanger analysis – LMTD for parallel and counter flow heat exchanger, effectiveness– NTU method for parallel and counter flow heat exchanger, cross flow heat exchanger, LMTD correction factor, design criteria for heat exchanger, Introduction to TEMA standards.

Introduction to heat pipe, Introduction to electronic cooling - Discussion on active and passive methods.

Books:**Text:**

1. F.P. Incropera, D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley.
2. Y. A. Cengel and A.J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited.
3. S.P. Sukhatme, A Textbook on Heat Transfer, Universities Press.
4. R.C. Sachdeva, Fundamentals of Engineering Heat and Mass Transfer, New Age Science.
5. P.K. Nag, Heat & Mass Transfer, McGraw Hill Education Private Limited.
6. M. M. Rathod, Engineering Heat and Mass Transfer, Third Edition, Laxmi Publications, New Delhi
7. V. M. Domkundwar, Heat Transfer,

References:

1. A.F. Mills, Basic Heat and Mass Transfer, Pearson.
2. S. P. Venkatesan, Heat Transfer, Ane Books Pvt. Ltd.
3. Holman, Fundamentals of Heat and Mass Transfer, McGraw – Hill publication.
4. M. Thirumaleshwar, Fundamentals of Heat and Mass Transfer, Pearson Education India.
5. B.K. Dutta, Heat Transfer-Principles and Applications, PHI.
6. C.P. Kothandaraman, S. V. Subramanyam, Heat and Mass Transfer Data Book, New Academic Science.
7. Databook, SPPU provided by the Exam Center

LIST OF EXPERIMENTS

Any eight experiments (1-11) and two assignments (12-14) from the following list

1. Determination of Thermal Conductivity of metal rod
2. Determination of Thermal Conductivity of insulating powder
3. Determination of Thermal Conductivity of Composite wall
4. Determination of Thermal Contact Resistance
5. Determination of heat transfer coefficient in Natural Convection
6. Determination of heat transfer coefficient in Forced Convection
7. Determination of temperature distribution, fin efficiency in Natural / Forced Convection
8. Determination of Emissivity of a Test surface
9. Determination of Stefan Boltzmann Constant
10. Determination of effectiveness of heat exchanger
11. Study of pool boiling phenomenon and determination of critical heat flux
12. Assignment on 1-D transient heat transfer program using finite difference methods.
13. Assignment to solve transient heat transfer problem using Heisler and Grober charts.
14. Assignment on multi-pass / cross-flow heat exchanger using effectiveness charts.

Savitribai Phule Pune University, Pune
Third Year of Mechanical
(2015 Course)

Course Code: 302046

Course Name: Skill Development

Teaching Scheme:

Credits

Examination Scheme:

PR: -- 2 Hrs/ Week

TW/PR:--01

TW:-- 25

PR:-- 25

COURSE OBJECTIVES

1. To develop the skill for required in shop floor working.
2. To have knowledge of the different tools and tackles used in machine assembly shop.
3. Use of theoretical knowledge in practice.
4. Practical aspect of the each component in the assembly of the machine.

Course Contents

List of Experiments

1. Tail stock assembly
2. Valve Assembly (PRV, Sluice valve, Steam stop valve)
3. IC engine of Two Wheeler (4 stroke single cylinder)
4. Hermetically sealed compressor
5. Hydraulic actuator
6. Industrial Gear box
7. Sheet drawing (Sheet will be given per group and a group consist of 04 students. The sheet will be drawn manually by every student)

Note: 1-6 experiments are for assembly and disassembly only

Term-Work

1. Sheet drawing of assembly, which should contain the display of Geometric tolerances, Limits, Fits, BOM, Dimensional measurements techniques. Special Operations.. Students should make process sheet of each assembly. (One topic per four students group will be given for sheet drawing and each student should draw the sheet manually)

Practical Examination

Practical examination will be based on opening and closing of any assembly. In addition to this some questioning will be asked to the student based on assembly drawing, GD&T Sequencing and tools and tackles. For this the assemblies and their drawings should be provided to students for examination

Note: Term work will carry 25 Marks and practical examination will carry 25 marks.

- A. The assessment has to be carried out based on close monitoring of involvement and intellectual contribution of student.
- B. The student should maintain the record of work in the form of diary and has to be submitted at the end of semester.
- C. The batch teacher should assess the concerned student

Savitribai Phule Pune University, Pune

TE Mechanical (2015 course)

Course Code: 302049

Course Name : Refrigeration and Air Conditioning

Teaching Scheme:	Credits	Examination Scheme:
TH : 03 hrs/week	TH:-- 03	TH In-Sem: -- 30
PR : 02 hrs/ week	OR:- 01	End-Sem: -- 70
		OR: -- 25

Prerequisites:

Basic Thermodynamics- Laws of thermodynamics, Ideal gas processes, Thermodynamic cycles, Properties of pure substance, Mollier Charts, Basic Psychrometry terms and process, Fluid properties, Fluid dynamics, Modes of heat transfer, Governing Equations in Heat Transfer, Extended Surfaces, Condensation and Boiling, Heat Exchangers.

Course Objectives:

- Learning the fundamental principles and different methods of refrigeration and air conditioning.
- Study of various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.
- Comparative study of different refrigerants with respect to properties, applications and environmental issues.
- Understand the basic air conditioning processes on psychometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
- Study of the various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems

Course Outcomes:

At the end of this course the students should be able to

- Illustrate the fundamental principles and applications of refrigeration and air conditioning system
- Obtain cooling capacity and coefficient of performance by conducting test on vapour compression refrigeration systems
- Present the properties, applications and environmental issues of different refrigerants
 - Calculate cooling load for air conditioning systems used for various
 - Operate and analyze the refrigeration and air conditioning systems.

Course Contents**Unit I: Applications of Refrigeration and Air Conditioning and Refrigerants [8 hrs]****Applications**

Domestic Refrigerator, Domestic Air Conditioners, Automotive Air Conditioners, Evaporative coolers, water coolers, Commercial Refrigeration- Dairy, Cold storage, Ice plant, Commercial Air Conditioning-Multiplex, Hospitals.

Refrigerants

Classification of refrigerants, Designation of refrigerants, Desirable properties of refrigerants, environmental issues, Ozone depletion and global warming, ODP, GWP & LCCP, selection of environment friendly refrigerants, secondary refrigerants, anti-freeze solutions, Zeotropes and Azeotropes, refrigerant: recovery reclaims, recycle and recharge.

Unit II: Vapour Refrigeration Systems [8 hrs]**Vapour compression systems**

Working of simple vapour compression system, representation of vapour compression cycle (VCC) on T-s and P-h diagram, COP, EER, SEER, IPLV, NPLV, effect of operating parameters on performance of VCC, actual VCC, methods of improving COP using flash chamber, sub-cooling, liquid vapour heat exchanger, comparison of VCC with Reverse Carnot cycle.

Vapour absorption systems

Introduction, Working of simple vapour absorption system (VAS), desirable properties of binary mixture (aqua-ammonia), performance evaluation of simple VAS (simple numerical treatment), actual VAS, Li-Br absorption system, three fluid system (Electrolux refrigeration), applications of VAS, comparison between VCC and VAC

Unit III: Multiple pressure Refrigeration Systems [8 hrs]

Introduction, need of multistage system, Intermediate pressure, two stage compression with flash gas removal and liquid intercooler, single compressor with multiple evaporator: individual and multiple expansion valves, individual compressors, cascade system: application and numerical(numerical only by using p-h chart),

Introduction to cryogenics (Linde - Hampson cycle) and applications (no numerical treatment)

<p>Unit IV: Psychrometry and Air conditioning load estimation [8 hrs]</p> <p>Psychrometry Basic Psychrometry and processes, BPF of coil, ADP, adiabatic mixing of two air streams, SHF, RSHF, GSHF, ESHF. Factors contributing to cooling load, Numerical based on load analysis</p> <p>Human Comfort Thermodynamics of human body, comfort and comfort chart, factors affecting human comfort, concept of infiltration and ventilation, indoor air quality requirements,</p>
<p>Unit V: Air Conditioning Systems [8 hrs]</p> <p>Air Conditioning Systems Working of summer, winter and all year round AC systems, all air system, all water system, air water system, variable refrigerant flow and variable air volume systems, unitary and central air conditioning.</p> <p>Components of refrigeration and air conditioning systems Working of reciprocating, screw and scroll compressors, working of air cooled, water cooled and evaporative condensers, working of DX, Flooded, Forced feed evaporators, Expansion devices – Capillary tube, TXV, EXV, operating and safety controls.</p>
<p>Unit VI [8 hrs]</p> <p>Air Distribution Systems</p> <p>Part A] Ducts Classification of ducts, duct material, pressure in ducts, flow through duct, pressure losses in duct (friction losses, dynamic losses), air flow through simple duct system, equivalent diameter, Methods of duct system design: equal friction, velocity reduction, static regain method (numerical on duct system design)</p> <p>Part B] Air handling unit Air handling unit, Fan coil unit, types of fans used air conditioning applications, fan laws, filters, supply and return grills, sensors (humidity, temperature, smoke).</p>
<p>Books:</p>
<p>Text:</p> <ol style="list-style-type: none"> 1. Arora C. P., Refrigeration and Air Conditioning, Tata McGraw-Hill 2. Manohar Prasad, Refrigeration and Air Conditioning, Willey Eastern Ltd, 1983 3. McQuiston, — Heating Ventilating and air Conditioning: Analysis and Design 6th Edition, Wiley India 4. Arora and Domkundwar, Refrigeration & Air Conditioning, Dhanpatrai & Company, New Delhi 5. Khurmi R.S. and Gupta J.K., Refrigeration and Air conditioning, Eurasia Publishing House Pvt. Ltd, New Delhi, 1994. 6. Ballaney P.L., Refrigeration and Air conditioning, Khanna Publishers, New Delhi, 1992

References:

1. Dossat Ray J, Principles of refrigeration, S.I. version, Willey Eastern Ltd, 2000
2. Stockers W.F and Jones J.W., Refrigeration and Air conditioning, McGraw Hill International editions 1982.
3. Threlkeld J.L, Thermal Environmental Engineering, Prentice Hall Inc., New Delhi.
4. Anantnarayan, Basics of refrigeration and Air Conditioning, Tata McGraw Hill Publications
5. Roger Legg, Air Conditioning System Design, Commissioning and Maintenance
6. ASHRAE & ISHRAE handbook

Term-Work

The term work shall consist of minimum eight experiments out of the following (It should include the visit to cold storage plant or central air-condition plant) :

1. Test on Domestic Refrigerator for evaluation of EER
2. Test on vapour compression test rig
3. Test on air conditioning test rig
4. Test on ice plant test rig
5. Test on Heat Pump test rig
6. Test/visit on Vapour absorption refrigeration test rig
7. Estimation of cooling load of simple air conditioning system (case study)
8. Visit to cold storage plant.
9. Visit to any air conditioning plant
10. Thermal analysis of refrigeration cycle using suitable software
11. Installation and servicing of split air conditioner.

**Structure of S.E. (Mechanical Engineering/ Automobile Engineering)
2015 Course**

Semester-I

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks	Credits	
		Hours/Week			In-Sem (online)	End-Sem	TW	PR.	Oral		Lect/Tut	PR/OR
		L	Tut.	PR								
207002	Engineering Mathematics – III	04	01	-	50	50	25	-	-	125	05	-
202041	Manufacturing Process-I	03	-	02	50	50	50	-	-	150	03	01
202042	Computer Aided Machine Drawing	01	-	02	--	--		50	-	50	01	01
202043	Thermodynamics	04	-	02	50	50	-	-	50	150	04	01
202044	Material Science	03	01	-	50	50	25	-	-	125	03	01
202051	Strength of Materials	04	-	02	50	50	-	-	50	150	04	01
202055	Audit course											
					--	--						
	Total	19	02	08	250	250	100	50	100	750	20	05
	Total of Part-I	29 Hrs					750				25	

Note: Material Science and Engineering Mathematics-III practical may be carried out fortnightly for two hours, so that the tutorial hours may be used as practical.

Semester-II

Subject Code	Subject	Teaching Scheme			Examination Scheme					Total Marks	Credits	
		Hours/Week			In-Sem (online)	End-Sem	TW	PR.	Oral		Lect/Tut	PR/OR
		L	Tut.	PR								
202045	Fluid Mechanics	04	-	02	50	50	-	50	-	150	04	01
202047	Soft Skills	-	-	02	--	--	25	-	-	25	-	01
202048	Theory of Machines – I	04	01	-	50	50	25	-	25	150	04	01
202049	Engineering Metallurgy	03	01	-	50	50	-	-	25	125	03	01
202050	Applied Thermodynamics	04	-	02	50	50	-	50	-	150	04	01
203152	Electrical and Electronics Engineering	03	-	02	50	50	25	-	-	125	03	01
202053	Machine Shop – I	-	-	02	--	--	25	-	-	25	-	01
	Total	18	02	10	250	250	100	100	50	750	18	07
	Total of Part-II	30 Hrs					750				25	

Note: Theory of Machine-I and Engineering Metallurgy practical may be carried out fortnightly for two hours, so that the tutorial hours may be used as practical.

2043: Thermodynamics

Teaching Scheme:	Credits	Examination Scheme:	
TH: 04 Hr/week	Th:04	TH	In-Sem: 50
			End-Sem: 50
PR: 02 Hrs/week	PR/OR/TW:01	PR:	--
		OR:	50
		TW:	--

Prerequisites: -

1. Engg. Mathematics
2. Engg. Physics/Chemistry
3. Fundamental Concepts and laws of Thermodynamics.

Course Objectives:

- Identify and use units and notations in Thermodynamics.
- State and illustrate first and second laws of Thermodynamics.
- Explain the concepts of entropy, enthalpy, reversibility and irreversibility.
- Apply the first and second laws of Thermodynamics to various gas processes and cycles.
- To get conversant with properties of steam, dryness fraction measurement, vapor processes and Thermodynamic vapor cycles, performance estimation.
- To get conversant with Psychrometric Charts, Psychrometric processes, human comfort conditions.

Course Outcomes:

- On completion of the course, learner will be able to–
- Apply various laws of thermodynamics to various processes and real systems.
- Apply the concept of Entropy, Calculate heat, work and other important thermodynamic properties for various ideal gas processes.
- Estimate performance of various Thermodynamic gas power cycles and gas refrigeration cycle and availability in each case.
- Estimate the condition of steam and performance of vapour power cycle and vapour compression cycle.
- Estimate Stoichiometric air required for combustion, performance of steam generators and natural draught requirements in boiler plants.
- Use Psychrometric charts and estimate various essential properties related to Psychrometry and processes

Course Contents

<p>Unit I Laws of thermodynamics (6 Hrs)</p> <p>Introduction of thermodynamics, Review of basic definitions, Zeroth law of thermodynamics, Macro and Microscopic Approach, State Postulate, State, Process and Thermodynamic Cycles, First law of thermodynamics, Joules experiment, Applications of first law to flow and non flow processes and cycles. Steady flow energy equation and its application to different devices. Equivalence of Clausius and Kelvin Planck Statement, PMM I and II, Concept of Reversibility and Irreversibility.</p>
<p>Unit II Entropy (4 Hrs)</p> <p>Entropy as a property, Clausius inequality, Principle of increase of Entropy, Change of entropy for an ideal gas and pure substance.</p> <p>Ideal Gas (6 Hrs)</p> <p>Ideal Gas definition Gas Laws: Boyle's law, Charle's law, Avagadro's Law, Equation of State, Ideal Gas constant and Universal Gas constant, Ideal gas processes- on P-V and T-S diagrams Constant Pressure, Constant Volume, Isothermal, Adiabatic, Polytropic, Throttling Processes, Calculations of heat transfer, work done, internal energy. Change in entropy, enthalpy.</p>
<p>Unit III Thermodynamic cycles (6 Hrs)</p> <p>Gas Power Cycles: Air Standard Cycle, Efficiency and Mean Effective Pressure, Carnot Cycle, Otto Cycle, Diesel cycle, Dual cycle, Comparison of cycles, Brayton cycle, Gas Refrigeration Cycle: Reversed Carnot, Bell Coleman Cycle.</p> <p>Availability (4 Hrs)</p> <p>Available and unavailable energy, concept of availability, availability of heat source at constant temperature and variable temperature, Availability of non flow and steady flow systems, Helmholtz and Gibbs function, irreversibility and second law efficiency.</p>
<p>Unit IV Properties of Pure substances (5 Hrs)</p> <p>Formation of steam, Phase changes, Properties of steam, Use of Steam Tables, Study of P-v, T-s and Mollier diagram for steam, Dryness fraction and its determination, Study of steam calorimeters (Barrel, Separating, Throttling and combined)</p> <p>Non-flow and Steady flow vapour processes, Change of properties, Work and heat transfer.</p> <p>Thermodynamic Vapour Cycle (5 Hrs)</p> <p>Vapour Power Cycles: Carnot cycle, Rankine cycle, Comparison of Carnot cycle and Rankine cycle, Efficiency of Rankine cycle, Relative efficiency, Effect of superheat, boiler and condenser pressure on performance of Rankine cycle, Vapour Refrigeration Cycles: Reversed Carnot Vapor Cycle, Vapor Compression Cycle and representation of cycle on P-h and T-s diagram, Refrigerating effect, Compressor power and COP estimation (Numerical treatment using R134a only and enthalpy Cp, Cv data should be provided in tabulated form).</p>

Unit V Steam Generators (6 Hrs) Introduction to fuels, Theoretical amount of Oxygen / Air required for combustion. Stoichiometric Air: Fuel ratio, Excess air, lean and rich mixtures, Stoichiometric A: F ratio for petrol (No Numerical Treatment on fuels and combustion, only basic definitions and terminologies to be covered). Classification, Constructional details of low pressure boilers, Features of high pressure (power) boilers, Introduction to IBR, Boiler performance calculations-Equivalent evaporation, Boiler efficiency Energy balance, Boiler draught (natural draught numerical only).
Unit VI Psychrometry (6 Hrs) Psychrometry and Psychrometric Properties, Basic Terminologies, Psychrometric Relations, Psychrometric Chart, Psychrometric Processes, Thermodynamics of Human Body, Comfort Conditions (Numerical treatment using Psychrometric chart only).
Books:
Text: 1. R. K. Rajput, Engineering Thermodynamics, EVSS Thermo Laxmi Publications 2. P. K. Nag, Engineering Thermodynamics, Tata McGraw Hill Publications 3.
Reference: 1. Y. Cengel & Boles: Thermodynamics – An Engineering Approach, 2. P. L Ballany: Thermal Engineering, Khanna Publishers 3. C.P. Arora: Engineering Thermodynamics, Tata McGraw Hill. 4. S. Domkundwar, C. P. Kothandaraman, Anand Domkundwar, Thermal Engineering, Dhanpat Rai Publishers.

202054 B : Road Safety

Prerequisites:

1. Awareness about traffic rules and road accidents.
2. Understanding the need of studying such topics.
3. Considerations to other, sensitivity and care while travelling/ driving.

Course Objectives:

- To acquire knowledge and understanding of the road environment.
- To inculcate decision making and behavioral skills necessary to survive in the road environment.
- To impart knowledge and understanding of the causes and consequences of accidents.
- To understand roles and responsibilities in ensuring road safety.

Course Outcomes:

On completion of the course, learner will be able to–

- Generate awareness about number of people dying every year in road accidents, traffic rules and characteristics of accident.
- Gain information and knowledge about people responsible for accidents and their duties
- Understand the importance of multidisciplinary approach to planning for traffic safety and rehabilitation
- Acquire a certificate of coordination/ participation in compulsory events based on the topic under study

Course Contents

Unit I: Introduction to Road Safety

(2 Hrs)

Road traffic accidents scenario in India and in world. Road Safety and its importance. Traffic Rules and Driving Behavior. Characteristics of accidents, accidents vs. crash.

Unit II: Planning for Road safety

(2 Hrs)

Awareness about rules and regulations of traffic. Assisting Traffic control authorities. Multidisciplinary approach to planning for traffic safety and injury control. Vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled.

Unit III: Responsibility of Road accidents and Safety measures

(2 Hrs)

People responsible for accident prevention: Police, Politicians, Community members, Policy makers, Teachers, Parents, Infrastructure authorities, Drivers and Official road safety body. Reasons of students/ children have accidents. 4 E's of Accidents Prevention: 1. Engineering - by altering the environment 2. Enforcement - by imposing laws 3. Encouragement - by the use of publicity campaigns 4. Education - by gaining and using knowledge.

<p>Unit IV: Road Safety Education (2 Hrs)</p> <p>Introduction to Road Safety Education. 5 P's of Road safety education: 1. Pre-school road safety education 2. Practical rather than theory education 3. Principles of own development as regards to road safety education 4. Presentations on road safety education 5. Place for road safety education in syllabus</p>
<p>Unit V: Road Safety Events (2 Hrs)</p> <p>Discussions on efforts done by Government on Road Safety. Celebration of Road Safety week or Workshop on Road Safety week/ Organization of seminar on Road Safety. This is to be entirely organized by students under the mentorship of concerned Head of the Department.</p>
<p>Books:</p>
<p>Text:</p> <ol style="list-style-type: none"> 4. Kadiyali L.R., Traffic Engineering & Transport Planning, Khanna Publishers, 2003 5. CROWN AGENTS Ref: TEA/A369, 1995. (Unpublished contractors report for Ministry of Transport and Communications, Ghana). Road safety study and the institutional strengthening of the vehicle examination and licensing division. 6. TRRL OVERSEAS UNIT, 1991. Towards safer roads in developing countries: a guide for planners and engineers. Crow Thorne: Transport and Road Research Laboratory.
<p>Reference:</p> <ol style="list-style-type: none"> 3. Indian Roads Congress, Highway Safety Code, IRC: SP-44:1996 4. Indian Roads Congress, Road Safety Audit Manual, IRC:SP-88-2010
<p>List of Tutorials/ Assignments:</p> <ol style="list-style-type: none"> 6. Discussion and presentations on: Road traffic accidents scenario in India. Traffic Rules and Driving Behavior. Characteristics of accidents, accidents vs. crash. 7. Discussion and presentations on: Assisting Traffic control authorities, Multidisciplinary approach to planning for traffic safety and injury control. Vulnerable road users: crashes related to pedestrian and bicyclists, their safety, provision for disabled. 8. Discussion and presentations on: People responsible for accident prevention, 4 E's of Accidents Prevention. 9. Introduction to Road Safety Education. 5 P's of Road safety education 10. Organization of One Day seminar/ workshop by students on Road Safety. Participation for every student is compulsory. They are expected to prepare brief report of about 3 to 4 pages of this event.
<p>Notes: All above 5 tutorials/ assignments are compulsory</p>

202050: Applied Thermodynamics

Teaching Scheme:	Credits	Examination Scheme:
TH: 04 hr/week	Th:04	TH In-Sem: 50
PR: 02 hrs/week	PR/OR/TW:01	End-Sem: 50
		PR: 50
		OR: --
		TW: --

Prerequisites: - 1. Engineering Thermodynamics.
2. Engineering Mathematics

Course Objectives:

- To get familiar with fundamentals of I. C. Engines, Construction and working Principle of an Engine and Compare Actual, Fuel-Air and Air standard cycle Performance.
- To study Combustion in SI and CI engines and its controlling factor in order to extract maximum power.
- To study emission from IC Engines and its controlling method, Various emission norms.
- Perform Testing of I. C. Engines and methods to estimate Indicated, Brake and Frictional Power and efficiencies
- To understand theory and performance Calculation of Positive displacement compressor.

Course Outcomes:

On completion of the course, learner will be able to–

- Classify various types of Engines, Compare Air standard, Fuel Air and Actual cycles and make out various losses in real cycles.
- Understand Theory of Carburetion, Modern Carburetor, Stages of Combustion in S. I. Engines and Theory of Detonation, Pre-ignition and factors affecting detonation.
- Understand Fuel Supply system, Types of Injectors and Injection Pumps, Stages of Combustion in CI Engines, Theory of Detonation in CI Engines and Comparison of SI and CI Combustion and Knocking and Factors affecting, Criteria for good combustion chamber and types.
- Carry out Testing of I. C. Engines and analyze its performance.
- Describe construction and working of various I. C. Engine systems (Cooling, Lubrication, Ignition, Governing, and Starting) also various harmful gases emitted from exhaust and different devices to control pollution and emission norms for pollution control.
- Describe construction, working of various types of reciprocating and rotary compressors with performance calculations of positive displacement compressors.

Course Contents	
<p>Unit I Basics of IC Engines</p> <p>Heat Engine, IC and EC engines, I.C. Engine construction - components and materials, Engine nomenclature, Valve timing diagram, Intake and exhaust system, Engine classification, Applications.</p> <p>Fuel Air Cycle and Actual Cycle</p> <p>Fuel air cycle, Assumptions, Comparison with air standard cycle, Effect of variables on performance, Actual cycle and various losses, Comparison of Air standard Vs Fuel Vs Actual cycle.</p>	<p>(5 Hrs)</p> <p>(5 Hrs)</p>
<p>Unit II SI Engines</p> <p>Theory of Carburetion, Types of carburetors, Electronic fuel injection system, Combustion in spark Ignition engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, Phenomenon of Detonation in SI engines, effect of engine variables on Detonation. Combustion chambers, Rating of fuels in SI engines, Additives.</p>	<p>(5 Hrs)</p>
<p>Unit III CI Engines</p> <p>Fuel supply system, types of fuel pump, injector and distribution system, Combustion in compression ignition engines, stages of combustion, factors affecting combustion, Phenomenon of knocking in CI engine. Effect of knocking, Methods of knock control, Types of combustion chambers, rating of fuels in CI engines. Dopes & Additives, Comparison of knocking in SI & CI engines.</p>	<p>(5 Hrs)</p>
<p>Unit IV Testing of IC Engines</p> <p>Objective of testing, Various performance parameters for I.C. Engine - Indicated power, brake power, friction power, SFC, AF ratio etc. Methods to determine various performance parameters, characteristic curves, heat balance sheet.</p> <p>Supercharging</p> <p>Supercharging and turbo-charging methods and their limitations</p>	<p>(6 Hrs)</p> <p>(2 Hrs)</p>
<p>Unit V I.C. Engine Systems</p> <p>Cooling System, Lubrication System, Ignition System, Governing system, Starting System</p> <p>I.C. Engine Emissions and Control</p> <p>Air pollution due to IC engine and its effect, Emissions from petrol/gas and diesel engines, Sources of emissions, Euro norms, Bharat stage norms, Emission control methods for SI and CI engines</p>	<p>(6 Hrs)</p> <p>(4 Hrs)</p>

<p>Unit VI Positive Displacement Compressors (Reciprocating and Rotary) (10 Hrs)</p> <p>Reciprocating Compressor - Single stage compressor – computation of work done, isothermal efficiency, effect of clearance volume, volumetric efficiency, Free air delivery, Theoretical and actual indicator diagram, Multistaging of compressor, Computation of work done, Volumetric efficiency, Condition for maximum efficiency, Inter-cooling and after cooling, Capacity control of compressors</p> <p>Rotary Compressor – Introduction, vane compressors, roots blower, screw compressor. (Numerical treatment on Reciprocating compressor single stage and multistage only)</p>
<p>Books:</p>
<p>Text:</p> <ol style="list-style-type: none"> 1) V. Ganesan: Internal Combustion Engines, Tata McGraw-Hill 2) M.L. Mathur and R.P. Sharma: A course in Internal combustion engines, Dhanpat Rai 3) H.N. Gupta, Fundamentals of Internal Combustion Engines, PHI Learning Pvt. Ltd.
<p>Reference:</p> <ol style="list-style-type: none"> 1. Heywood: Internal Combustion Engine Fundamentals, Tata McGraw-Hill 2. Domkundwar & Domkundwar: Internal Combustion Engine, Dhanpat Rai 3. R. Yadav: Internal Combustion Engine, Central Book Depot, Ahmedabad. 3. S. Domkundwar, C. P. Kothandaraman, A. Domkundwar, Thermal Engineering, Dhanpat Rai & Co.
<p>List of Practical's:</p> <ol style="list-style-type: none"> 1. Study of Carburetor 2. Study of Fuel pump and injector 3. Study of Ignition System 4. Demonstration & study of commercial exhaust gas analyzers. 5. Morse Test on Multi cylinder Petrol/ Diesel engine for determination of Friction power. 6. Variable load test on diesel engine to determine various efficiencies, SFC and Heat balance sheet. 7. Test on variable compression ratio engine. 8. Visit to Automobile service station 9. Test on Positive Displacement Air Compressor 10. Assignment on any one advanced technology related to I.C. Engine such as VVT, VGT, HCCI 11. Assignment on alternative fuels used in I.C. Engines. <p>Notes:</p> <ol style="list-style-type: none"> 1. Minimum 8 experiments should be performed. 2. Perform any 3 from 1 to 4. 3. Perform any 2 from 5, 6, and 7. 4. Experiment 8 and 9 are compulsory.

Third Engineering-E&TC (2015 Course)**(With effect from Academic Year 2017-18)**

Semester II												
Course Code	Course	Teaching Scheme			Semester Examination Scheme						Credit	
		Hours / Week			of Marks						TH/TW	PR+OR
		Theory	Tutorials	Practicals	In-Sem	End-Sem	TW	PR	OR	Total		
304186	Power Electronics	4	--	--	30	70	--	--	--	100	4	--
304187	Information Theory, Coding and Communication Networks	4	--	--	30	70	--	--	--	100	4	--
304188	Business Management	3	--	--	30	70	--	--	--	100	3	--
306189	Advanced Processors	4	--	--	30	70	--	--	--	100	4	1
304190	System Programming and Operating Systems	3	--	--	30	70	--	--	--	100	3	1
304194	Power and ITCT Lab	--	--	4	--	--	50	50	--	100	--	2
304195	Advanced Processors and System Programming. Lab	--	--	4	--	--	50	50	--	100		
304196	Employability Skills and Mini Project	2	--	2	--	--	--	--	50	50	2	1
	Audit Course 4	--	--	--	--	--	--	--	--	--		
Total		20	---	10	150	350	100	100	50	750		
Total Credits											25	

Abbreviations:**TH: Theory****OR: Oral****TW: Term Work****PR: Practical**

Note: Interested students of T.E (Electronics/E&TC) can opt any one of the audit course from the audit courses prescribed by BoS (Electronics/Computer/IT/Electrical/Instrumentation)

304188**Business Management****Credits: 03****Teaching Scheme:****Lecture : 03 hr/week****Tutorial:****Examination Scheme:****In-Sem : 30 Marks****End-Sem : 70 Marks****Term Work :****Course Objectives:**

- To get awareness about various domains in Business Management.
- To understand concept of Quality Management, Financial Management and Project Management.
- To learn Human Resource Management, marketing management are the major tasks in Business
- To promote Entrepreneurship.

Course Outcomes:

On completion of the course, student will be able to

- 1) Get overview of Management Science aspects useful in business.
- 2) Get motivation for Entrepreneurship
- 3) Get Quality Aspects for Systematically Running the Business
- 4) To Develop Project Management aspect and Entrepreneurship Skills.

Course Contents**Unit I :Basics of Business Management****(8 Hrs)**

Introduction, Definition of management, characteristics of management, functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making, Principles of management – F.W.Taylor, Henry Fayol, Elton Mayo, Administration and management, Nature of management, levels of management, scientific management, managerial roles, Forms of Organization- Line , Line –staff,committee etc, Dist Business sectors & forms of business organizations- private sector,Cooperative sectors, public sector, joint sector, Services sector, Various forms of business organizations – Sole Proprietorship, Partnership firms, Joint stock companies -their features, relative merits, demerits & suitability. Concept of globalization

Unit II :Quality Management**(6 Hrs)**

Definition of quality, goalpost view of quality, continuous improvement definition of quality, types

of quality – quality of design, conformance and performance, phases of quality management, Juran’s and Demings view of quality, Quality Management Assistance Tools: Ishikawa diagram – Pareto Analysis – Pokka Yoke (Mi stake Proofing).quality circles, TQM, Kaizen, Five S (5S), Six sigma Quality Management Standards Application of six sigma a CASE study - The ISO 9001:2015 Quality Management System Standard. Software quality management with respect to CMM level and ISO standard.

Unit III : Financial Management and Project Management (6 Hrs)

Capital Structure, Fixed & working capital, Cash flow, Financial accounting concepts and application, Scope of business, Macro analysis, micro analysis, Demand and supply analysis. Function of money market and capital Market, sources of finance. Introduction to capital budgeting, Techniques of capital budgeting. Break even analysis - assumptions, importance, Cost-Benefit analysis,. Introduction to Project Management process (Project Life cycle Management),Project selection criteria, project scope, Project planning, scheduling , Resources and constrains. Project estimates and costing .Project qualitative and quantitative Risk analysis and Mitigation, project quality planning and deliverables. Case study of a project Mngement.

Unit IV : Human Resource Development (6 Hrs)

Strategic importance HRM; objectives of HRM; challenges to HR professionals; role, Responsibilities and competencies of HR professionals; HR department operations; Human Resource Planning - objectives and process; human resource information system.. Talent acquisition; recruitment and selection strategies, career planning and management, training and development, investment in training program; executive development, Case study on Recent trends in Human Resource Development. Case study of a HR of an organization.

Unit V : Entrepreneurship Development (6 Hrs)

Concept of entrepreneurship, Identification of business opportunities, Generation of business idea, Business plan, Preparation of business proposal, Sources of finance – government and nongovernment agencies, , Policies and incentives for small business development, Government policies and incentives, Woman entrepreneurship, Industrial relations, Case study on Small scale industries in India.

Unit VI : Marketing (6 Hrs)

Introduction to marketing, marketing environment, segmentation. Consumer behavior and Marketing management. Marketing research, pricing, advertising, branding and packaging. Personal selling and sales force Management .Modern marketing system (digital Mastering□marketing) Email Marketing, Social Media Marketing, Web Marketing, Google (Google Analytics, Advertising and

Applications), Facebook, LinkedIn, Twitter, Guides & Directories, Online Publications etc for sales, customer services, staff recruitment etc, Blogging and Micro Blogging Event Management, Online Payments, Disability Web Access, Surveys & Forms, Affiliate & Voucher Marketing, Crowd sourcing, Mobile Social Media (Geotagging etc) and Mobile Marketing, Mobile Applications (Apps and Mobile Web), Audio , Video podcasting.

Introduction to supply chain management and customer relationship management

Text Books:

- 1) O. P. Khanna, “Industrial Engineering and Management”, Dhanpatrai publications Ltd, NewDelhi.
- 2) L.C.Jhamb , Savitri Jhamb , Industrial Management – I , Everest Publishing House .
- 3) Jenniffer Greene, Andrew Stellman,Head First PMP 3rd Edition OREILLY Publication
- 4) Marketing Management-Phillip Kotlar, The Millennium Edition, PHI EEE Edition

Reference Books:

- 1) G. S. Batra , “Development of entrepreneurship ” , deep and deep publications, new delhi
- 2) Ashwathappa, “human resource management”, mc-gra w-hill education (india) pvt. Ltd.
- 3) M.Y. Khan and P. K. Jain, “financial management” , mc-graw-hill education (india) pvt. Ltd.
- 4) Ravi M. Kishore, “project management”, mc-graw-h ill education (india) pvt.
- 5) Pravin kumar, “ fundamentals of engineering economics”, wiley india
- 6) Monga. i.r. Financial Accounting: concepts and Applications, maytirpaperbacks
- 7) Business organization and management by dr. C. B. Gupta, publisher sultan chand & co. Delhi
- 8) Fundamentals of accounting & financial analysis: by Anil Chowdhry (Pearson education)
- 9) Textbook of economic theory - Stonier and Hague; LongmanGreen and co., london.
- 10) managerial economics - theory and application - D. M. Mithani

SE(E&TC/Electronics Engineering) 2015 Course**(With effect from Academic Year 2016-17)**

Semester II												
Course Code	Course	Teaching Scheme Hours / Week			Semester Examination Scheme of Marks						Credit	
		Theory	Tutorials	Practicals	In-Sem (on line)	End-Sem (Theory)	TW	PR	OR	Total	TH/TUT	PR+OR
207005	Engineering Mathematics III	4	1	-	50	50	25	-	-	125	5	-
204187	Integrated Circuits	4	-	2	50	50	25	50	-	175	4	1
204188	Control Systems	3	-	-	50	50	-	-	-	100	3	-
204189	Analog Communication	3	-	2	50	50	-	50	-	150	3	1
204190	Object Oriented Programming	3	-	4	50	50	-	-	50	150	3	2
204191	Employability Skill Development	2	-	2	-	-	50	-	-	50	2	1
204193	Audit Course 2	--	--	--	--	--	--	--	--	--		
Total		19	1	10	250	250	100	100	50	750	20	05
Total Credits											25	

Abbreviations:

TH: Theory
 TW: Term Work
 OR: Oral

TUT: Tutorial
 PR: Practical

Note: Interested students of S.E (Electronics/E&TC) can opt any one of the audit course from the audit courses prescribed by BoS (Electronics/Computer/IT/Electrical/Instrumentation)

Audit Course-I 204192: Road Safety Management
<p>Road transport remains the least safe mode of transport, with road accidents representing the main cause of death of people. The boom in the vehicle population without adequate road infrastructure, poor attention to driver training and unsatisfactory regulation has been responsible for increase in the number of accidents. India's vehicle population is negligible as compared to the World statistics; but the comparable proportion for accidents is substantially large.</p> <p>The need for stricter enforcement of law to ensure greater safety on roads and an environment-friendly road transport operation is of paramount importance. Safety and security are growing concerns for businesses, governments and the traveling public around the world, as also in India. It is, therefore, essential to take new initiatives in raising awareness, skill and knowledge of students as one of the ibid stake holders who are expected to follow the rules and policies of the government in order to facilitate safety of individual and safe mobility of others.</p>
<p>Course Objectives:</p> <ul style="list-style-type: none"> • Provide basic overview on road safety & traffic management issues in view of the alarming increase in vehicular population of the country. • Insight into the transportation system management (TSM) techniques. • Overview of the engineering & legislative measures for road safety. • Discuss measures for improving road safety education levels among the public.
<p>Course Outcomes:</p> <p>On completion of the course, society will observe –</p> <ul style="list-style-type: none"> • Changes in awareness levels, knowledge and understanding • A change in attitudes / behavior e.g. against drink-drive; • Casualty Reduction; • That remedial education for those who make mistakes and for low level offences where this is more effective than financial penalties and penalty points; • Improving Road Safety Together
Course Contents
<ol style="list-style-type: none"> 1. Existing Road Transport Scenario 2. Accident Causes & Remedies 3. Road Accident Investigation & Investigation Methods 4. Vehicle Technology – CMVR & Road Safety 5. Regulatory / Legislative Provisions for Improving Road Safety 6. Behavioral Training for Drivers for Improving Road Safety 7. Road Safety Education 8. Road Engineering Measures for Improving Road Safety
<p style="text-align: center;">Guidelines for Conduction (Any one or more of following but not limited to)</p> <ul style="list-style-type: none"> • Guest Lectures • Visits and reports • Assist authorities like RTO for audits (e.g. Particular road safety audit as critical on-site assessment of the shortcomings in the various elements of the road) • Mini Project

204191**EMPLOYABILITY SKILL DEVELOPMENT****Credits:Th – 02, Pr -01****Subject Code:****Teaching Scheme****Theory / Week : 2 Hrs****Practical /Week : 2Hrs.****Examination Scheme****Term Work: 50 Marks****Course Objectives:**

1. To develop analytical abilities
2. To develop communication skills
3. To introduce the students to skills necessary for getting, keeping and being successful in a profession.
4. To expose the students to leadership and team-building skills.

Course Outcomes: On completion of the course, student will be able to:

1. Have skills and preparedness for aptitude tests.
2. Be equipped with essential communication skills (writing, verbal and non-verbal)
3. Master the presentation skill and be ready for facing interviews.
4. Build team and lead it for problem solving.

Unit I :Soft Skills & Communication basics**(4Hrs)**

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills. Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing

Unit II: Arithmetic and Mathematical Reasoning**(4 Hours)**

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, remainder theorem)

Unit III: Analytical Reasoning and Quantitative Ability**(4 Hours)**

Matching, Selection, Arrangement, Verifications (Exercises on each of these types). Verbal aptitude (Synonym, Antonym, Analogy)

Unit IV: Grammar and Comprehension**(4 Hours)**

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing.

Unit V: Skills for interviews**(4Hours)**

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time.

Unit VI: Problem Solving Techniques**(4 Hours)**

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.

Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

Text Books:

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, "Soft Skills- An integrated approach to maximize personality", ISBN: 987-81-265-5639-7, First Edition 2016, Wiley.
2. Wren and Martin, "English grammar and Composition", S. Chand publications.
3. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.

Reference Books:

1. Philip Carter, "The Complete Book Of Intelligence Test", John Willey & Sons Ltd.
2. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page
3. Eugene Ehrlich, Daniel Murphy, "Schaum's Outline of English Grammar", McGraw Hills.
4. David F. Beer, David A. McMurrey, "A Guide to Writing as an Engineer", ISBN : 978-1-118-30027-5 4th Edition, 2014, Wiley.

List of Practical:

1. Every student should collect five questions of each type
 - a. Number sequence
 - b. Mental arithmetic
 - c. Square, square roots
 - d. LCM, HCF
 - e. Speed calculations

Note: Teacher should distribute the question set randomly amongst the students.

2. Write up on
 - a. Blooms taxonomy
 - b. Multiple intelligence theory
 - c. Every student should identify his/her strength and weaknesses
 - d. Action plan to improve the weaknesses
3. Every student should collect five questions of each type
 - a. Matching
 - b. Selection
 - c. Arrangements
 - d. Verifications

Note: Teacher should distribute the question set randomly amongst the students.

4. Every student should collect five questions of each type
 - a. Verbal aptitude
 - b. Synonym
 - c. Antonym
 - d. Analogy

Note: Teacher should distribute the question set randomly amongst the students.

5. Solve exercises from book (Wren and Martin, "English grammar and Composition") based on
 - a. English sentences and phrases
 - b. Paragraph writing
 - c. Story writing
 - d. Letter writing
6. Formulate suitable assignment to solve a real problem using problem solving techniques
7. Practice tests (aptitude, analytical abilities, logical reasoning)
8. Extempore, group discussions and debate.
9. Technical report writing and Seminar Presentation.
10. Mock interviews.

§ : Mandatory subjects of first, second and third semester must include at least 40 credits for Engineering Physics, Engineering Chemistry, Engineering Mathematics, social science and soft skills
In addition to above credits, there should be audit courses in semester five, six and seven to develop the various skills.

The detail structure is given in Tables

TABLE - 2 Structure for Semester-1

Code	Subjects	Short Name	Weekly Work Load (in Hrs)			Semester Examination Scheme of Marks						Credits
			Lectures	Tutorials	PR/DRG	Theory		TW	PR	OR	Max. Marks	
						In-Semester Exam	End-Semester Exam					
107001	Engineering Mathematics I		4	1	–	50	50	25	–	–	125	5
# 107002 / 107009.	Engineering Physics OR Engineering Chemistry		4	–	2	50	50	25	–	–	125	5
102006	Engineering Graphics I		3	–	2	50	50	–	–	–	100	4
# 103004 / 104012	Basic Electrical Engineering OR Basic Electronics Engineering		3	–	2	50	50	25	–	–	125	4
101005	Basic Civil and Environmental Engineering		3	–	2	50	50	25	–	–	125	4
110003	Fundamentals of Programming Languages I		1	–	2	–	–	–	50*	–	50	2
111007	Workshop Practice		–	–	2	–	–	50	–	–	50	1
Total of Semester I			18	1	12	250	250	150	50	–	700	25